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Motorship

ILLUSTRATIONS of the newest designs in international merchant motorship and Diesel-engine construction and auxiliary equipment.

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Asturias, a 22,000-Ton Motorliner Launched

First of the Two Palatial Passenger Vessels for the South American Service of the R. M. S. P. Takes the Water

WITH the launching of the big motorliner ASTURIAS and of her sister vessel the first of the Harland & Wolff passenger motorships advanced to the final stage of completion. ASTURIAS is one of two sister vessels ordered by the Royal Mail Steam Packet Company for its service between England and South America.

These boats measure 22,000 tons gross, with an overall length of 655 ft. 8 in., breadth 78 ft. and depth 45 ft. and it may be remarked here that this mazagine has consistently given correct dimensions of the R. M. S. P. motorliners, whereas other motorship and engineering publications here and abroad have always quoted them incorrectly, even so late as last month. ASTURIAS will be propelled by twin double-acting Diesel engines of 7500 s. hp. each. These engines have the same cylinder dimensions as those of the GRIPSHOLM, which is expected to make its first passage across the Atlantic this Fall, but they are built with eight cylinders instead of six cylinders. The actual s. hp. is not much greater, because the 8-cylinder Harland & Wolff engines drive their own compressors, whereas the 6-cylinder engines of the GRIPSHOLM will take their air supply from independent compressors. The GRIPSHOLM engines will give about 6750 s. hp.; the engines of the ASTURIAS and of her sister vessel the ALCANTARA will develop 7500 s. hp.

Asturias takes the water

In addition to the two big main engines these vessels will have four auxiliary Diesel engines of about 550 b. hp. each, direct connected to 400 kw. electric generating sets, besides an additional Diesel set of about 100 hp. driving a 75 kw. generator and installed on one of the upper decks for lighting the vessel in case of the engineroom being flooded.

All the engineroom auxiliaries will be driven by independent electric motors.

Three motorliners, exceeding 20,000 tons each, have been built side by side at the big Belfast yard

There is a small emergency steam driven compressor, steam being available from two oil-fired vertical boilers installed to provide steam for cooking purposes. No steam is used for heating the ship, the heating throughout being electric—over 500 electric radiators being installed in the public rooms and cabins. There will be 4000 lights distributed throughout the vessel and high candle power lamps and lanterns to assist in the handling of cargo at night.

The demands for power made by the ventilation system are quite considerable. These ships having to cross the Equator and to voyage in hot climates are provided with a system for delivering cold air to the passenger accommodation. Over 50 large fans will be used for this purpose, and in the cabins and public rooms there will be ceiling and wall fans to the number of about 500. All cooking will be done on electric ranges, as well for the crew as for the passengers. Even the baker's ovens will be electrically heated. On deck the electrical equipment includes a 135 hp. warping winch, two 150 hp. capstans and a 136 hp. windlass, besides the motors for the electro-hydraulic steering gear. Of the other electrical equipment on board the vessel mention need only be made of the seven electrically operated elevators and hoists.

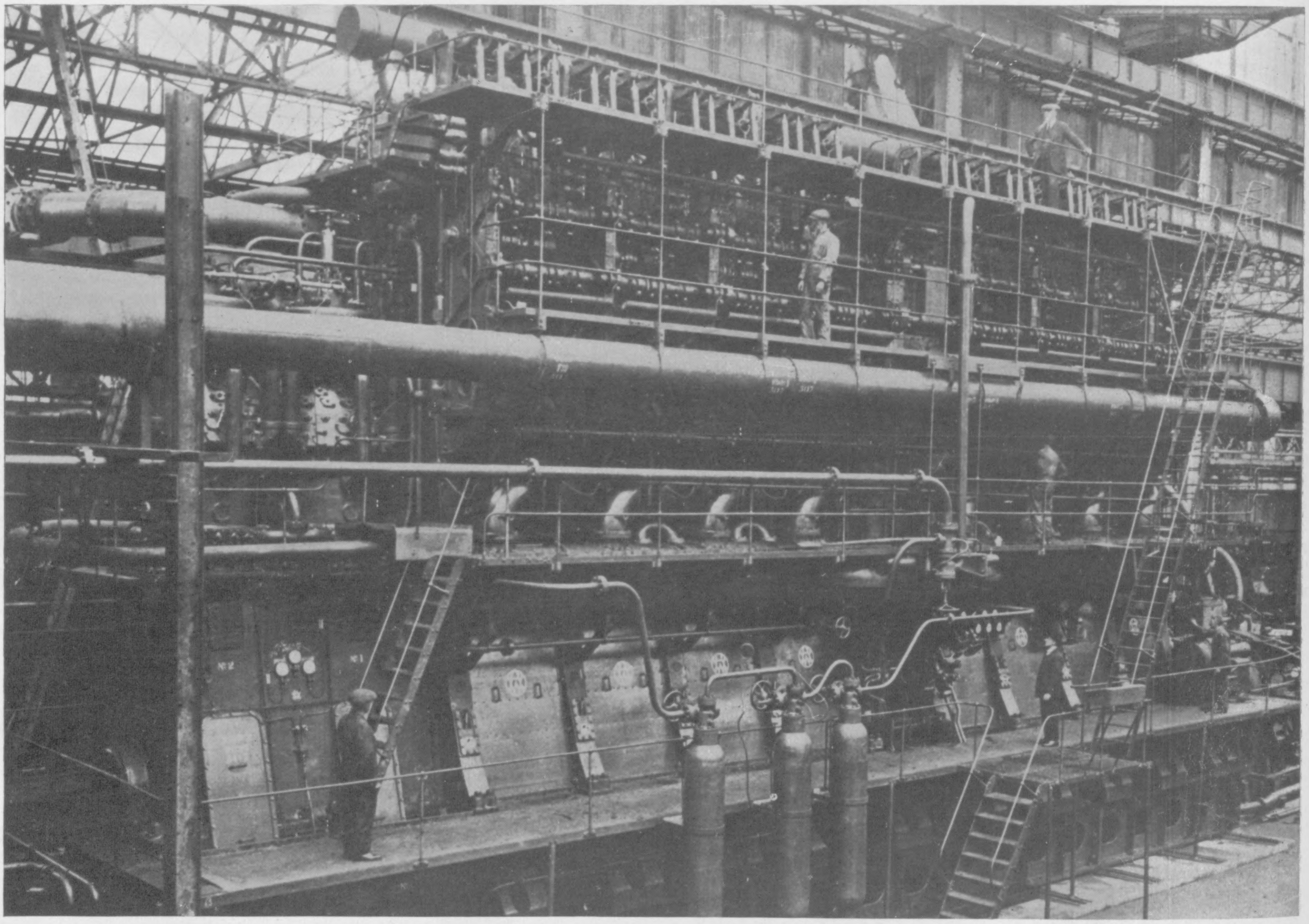
These vessels, ASTURIAS and ALCANTARA, have a straight stem and cruiser stern, with 11 watertight bulkheads dividing the ship into 12 compartments. The doors through the watertight bulkheads are electrically operated and controlled. The ships are to be equipped and decorated in a most luxurious manner. The total accommodation provided will be for 1740 passengers and crew. In the passenger accommodation there will be two staircases, each extending through six decks with a height of about 60 ft. from the top of the skylight down to the orlop deck. The forward staircase begins at the swimming bath on the orlop deck and mounts to the social hall on E deck, communicating on A deck with the entrance to the dining room, on B deck with the lounge entrance, on C deck with the general store at which passengers may do their shopping, and on D deck with the Inquiry Bureau. The staircase at the after end gives access to the smoke room, winter garden, children's playroom, etc., on the different decks.

Some idea of the extent of the space provided for public rooms may be gained from the fact that the dining room, which is 94 ft. long and 74 ft. broad has a central space 60 ft. long by 40 ft. broad extending two decks in height or a total of about 17 ft. Seating accommodation will be arranged for 412 passengers. The social hall will have a height of about 19 ft. and will be lighted by windows having central sashes measuring about 17 ft. 9 in. by 3 ft. 6 in. The decoration of the public rooms in the first class accommodation will be equal to that of any of the North Atlantic liners.

ASTURIAS will probably be finished up before the end of the year and the ALCANTARA will be launched about that time.

DINTELDYK, the Holland America Line motorvessel, came out of the Harland & Wolff yard at Belfast last month after having additional refrigerated space and other improvements installed. She is a vessel of about 9400 tons gross with registered dimensions 485.6 ft. × 62.3 ft. × 35.8 ft. equipped with two 8-cylinder Harland & Wolff engines developing an aggregate of 4600 s.hp. There are four main generating sets, each of 100 kw., driven by 3-cylinder Diesel engines. The steering gear, windlass and 15 cargo winches are all electrically driven. A sister vessel, the DRECHTDYK, is expected in Belfast soon to have additional refrigerated space and refrigerated machinery installed.

An additional cargo vessel, NAIRNBANK, has been delivered to the Bank Line by Harland & Wolff. Like the other twin screw motorships for the same line she is 434 ft. x 53 ft. 9 in. x 37 ft. with a gross tonnage of about 5200. She is of the shelter deck type with two complete steel decks. Winches are steam driven, but the steering gear is electrically driven and all the auxiliaries in the engine-room are electrically driven. The propelling power consists of two sets of Harland & Wolff Diesel engines. NAIRNBANK is a unit of the large standardized motorfleet of the Bank Line.



Starboard engine of the motorliner Asturias, an 8-cylinder 4-cycle double-acting 7500 s.hp. set with direct connected compressor

Tries Out 2-Cycle and 4-Cycle Engines

Nippon Yusen Kaisha Line Now Has Sister Motorships Atago Maru and Asuka Maru in Operation

METHODICAL plans for the adoption of Diesel power are being followed by the Nippon Yusen Kaisha of Tokio, which operates about 100 vessels in passenger and freight services on various trade routes of the world. Before building motorships in the larger classes of passenger liners the N. Y. K. has had two sister cargo ships built, identical in every respect except in the type of Diesel engines, the ATAGO MARU being equipped with 4000 s.hp. in twin four-cylinder two-cycle engines and the ASUKA MARU with 4000 s.hp. in twin eight-cylinder four-cycle engines.

The ATAGO MARU, the first motorship of the N. Y. K. fleet, reached British Columbia on her first regular run from Japan in May, 1925, and was followed on this route by the ASUKA MARU in a couple of months.

The ATAGO MARU, of 10,500 tons d.w., was built by Lithgows at Port Glasgow, while the main auxiliary Diesel engines came from Sulzer's plant in Switzerland. Her main engines are twin four-cylinder two-cylinder air-injection Sulzers of 2000 s.hp. each, and the auxiliaries are three four-cylinder two-cycle airless injection Sulzers of 200 b.hp. each, direct connected to 135 kw. generators.

ASUKA MARU was built by D. & W. Henderson at Glasgow, her main engines being twin eight-cylinder four-cycle Diesels of 2000 s.hp. each, and the auxiliaries three three-cylinder four-cycle 150 hp. Diesels direct connected to 100 kw. generators.

The greater power of the auxiliary engines in the ATAGO MARU is on account of the turbo blowers supplying scavenging air to the main engines.

T, Hamano, chief engineer of the ATAGO MARU, says that the trial speeds of the two ships worked out practically the same, the ATAGO MARU making 14.5 knots. The cost of the ships was not the same, the ATAGO MARU being about £180,000, and the ASUKA MARU about £200,000, the main difference being in the cost of the engines. There is also a considerable difference in the weight of the machinery. Mr. Hamano states that the weight of the two-cycle engines and auxiliaries is only about half the weight of the four-cycle engines and auxiliaries in the other ship. There is some saving of engine room space with the

Atago Maru, the 2-cycle ship

shorter two-cycle engines in the ATAGO MARU, her engine room being 56 ft. long compared with a 64 ft. engine room in the ASUKA MARU, while a more economical use of the available space might have saved another 6 ft. for the ATAGO if it had been considered necessary.

Four of the Japanese engineers, including Mr. Hamano, spent two years in Scotland and Switzerland during the construction of the ship and machinery, studying Diesel engines and watching the installation in the ship. Besides acquiring a knowledge of modern oil engines the officers also became enthusiastic golf players.

The ATAGO MARU went into commission late in 1924 and sailed from Glasgow to Cardiff, where a cargo of 5000 tons of coal was loaded for Port Said. From Port Said the ship proceeded to Bombay, where a cargo of cotton for Japan was loaded. On the voyage from Scotland to Japan an average speed of 11.5 knots was maintained. On arrival at Japan 40 days were taken up by a government survey of the ship.

On April 29, with Capt. Oya in command, ATAGO MARU started on her regular run from Yokohama to British Columbia and Puget Sound ports. She made the trip across the Pacific to Victoria, B. C., in 14 days at an average speed of 12.7 knots, the best day's run being at an average of 13.5 knots. Rough weather was experienced for several days after leaving Yokohama. Mr. Hamano says the engines have been working out very well. It has never been necessary to stop them for any kind of repairs since leaving Glasgow. He reported the pilot, who brought them into Vancouver, commenting that the ship maneuvered better than turbine steamers he had handled.

While the ATAGO MARU is strictly a cargo boat with the plain black funnel of the N. Y. K. line, she is a fine looking ship with good lines and having the most modern electric cargo handling equipment, consisting of three seven-ton, four five-ton and twelve three-ton winches, electric windlass and electro-hydraulic steering gear, while the cabins have vapo-electric heaters.

The main engines are of the two-cycle air-injection type with turbo blowers for scavenging, there being two of these blowers driven by 250 hp. electric motors. The control station is on the upper platform opposite the center of each engine, while the telegraphs are at the forward end of the engine room.

When running at sea, one senior engineer and one oiler are on duty on the upper platform, and another engineer and oiler

Engine room plans of the N.Y.K. sister ships compared: on the left the Atago Maru's, on the right the Asuka Maru's

on the lowest platform where the auxiliary engines, generators, pumps and auxiliary air compressors are installed in the wings and forward of the main engines. When maneuvering in port, one engineer is at each control station and one at the telegraph, with a fourth on the lowest platform. The engine room staff is made up of the Chief and six assistant engineers, one electrician with two assistant electricians, besides oilers, making fourteen all told. Two special engineers for instruction are being carried.

The auxiliary engines, of which there are three 200 hp. units, are of the four-cylinder airless injection type with oil cooled pistons. They work at a speed of 300 r.p.m., and are direct connected to 135 kw. generators. When all the winches are handling cargo in port, two of these auxiliaries are used, and two are also necessary when running at sea. When maneuvering in port the whole three are kept running, and at other times one is sufficient to handle the ordinary requirements of the ship.

There are two electric driven auxiliary air compressors and one small steam driven compressor for which an oil fired steam donkey boiler is provided.

A Vickson centrifuge is used for reclaiming lubricating oil, an electric heater being used in connection with it for raising the temperature of the oil when necessary.

Fuel oil is pumped to a settling tank before using. The first fuel taken on was a British-Mexican Diesel oil of 27 deg. Beaumé and a further supply of Borneo oil of 26 deg. Beaumé was loaded on the voyage to Japan. A further supply of fuel was taken at Seattle.

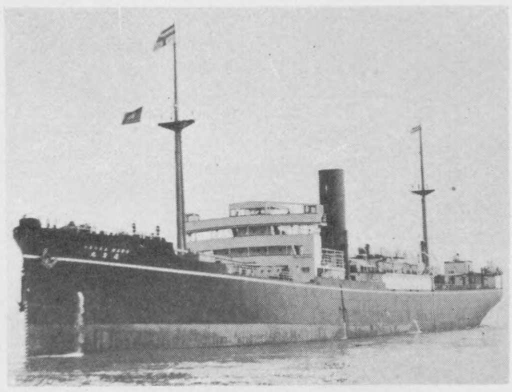
Part of the heat of the exhaust is used for heating salt water for baths.

Injection air is carried at a pressure of 1000 lb. per sq. in. and starting air at 450 lb. per sq. in. A smaller tank with air at 100 lb. per sq. in. pressure is used for the whistle.

Motorship Atago Maru

Length o. a.	454 ft.
Length b. p.	440 ft.
Breadth	57 ft.
Molded depth	38.6 ft.
Mean loaded draft	28 ft.
Displacement, loaded	15,154 tons
Displacement, light	4,500 tons
Dead weight capacity	10,500 tons
Deep tank capacity	800 tons
Double bottom fuel tanks	1,217 tons
Fresh water	200 tons
Endurance at 13 knots	28,000 miles
Shaft horsepower	4,000 s.hp.
Type of engine	Sulzer 2-cycle
Cylinder diameter	26.77 in.
Piston stroke	47.24 in.
Engine speed	100 r.p.m.
Ship's loaded speed	13 knots
Propeller diameter	15 ft.
Propeller pitch	14 ft.
Fuel consumption	15 tons per day
Lubricating consump.	12 gal. per day
Auxiliary sets	Three 4-cyl. 2-cycle 200 b.hp.
Port fuel consumption using 17 winches	0.7 to 0.8 ton per day
Number of engine room staff	14

The ASUKA MARU has also made her first run to the Pacific Coast of America calling at Victoria, Seattle and Vancouver early in July. She was commissioned last November and proceeded first to Japan. Her engines were built by Harland & Wolff at Glasgow, and are twin eight-cylinder four-cycle single acting Diesels of Burmeister & Wain type, developing 2000 b.hp. each at 125 r.p.m. They turn propellers of 13 ft. 4½ in. diameter, 12 ft. pitch, having three blades and an average slip of 10 per cent. The auxiliary machinery consists of three sets of three cylinder 150 b.hp. B. & W. type four cycle Diesels direct connected to generators. The three auxiliary engines are installed on the bottom platform on the port side of the engine room, while pumps, compressors, air bottles, etc. are located on the starboard side. The main engine controls are on the lowest platform.



Asuka Maru, the 4-cycle ship

The deck machinery is all electric, Lawrence-Scott winches of 3-ton, 5-ton and 7-ton sizes being installed. The electro-hydraulic steering engine is of the Hele Shaw type.

The fuel tank capacity of the double bottoms is 1160 tons, being sufficient for 2½ trips between America and Japan. The oil that has been used is a British-Mexican of 26 deg. Beaumé, and a California oil of about 23 deg. Beaumé was later taken on.

F. Kobayashi, the chief engineer, states that the ship was designed for 12.5 knots and a sea speed of 12 knots. On her trial she did a little better than 13 knots, but has improved on this speed considerably since.

On the trip from Yokohoma to Victoria, B. C., she averaged 13.24 knots in 326 hours 54 minutes running time, on an average daily consumption of 14.6 tons of fuel. Weather conditions were favorable, and the ship had a light cargo. The winds were principally fair. Only on one day was there a strong wind of force 6 (about 27 miles an hour) on the port bow. The best day's run was made on June 22 with a light wind aft and slight swell. The engine was turning up 127.2 r.p.m., a slight overload, and the distance by log was 329 miles, the average speed being 14.2 knots.

On her first voyage out to Japan the consumption of lubricating oil is said to have been 19 gal. a day, but on a subsequent trip to Bombay this was cut to 16 gal., which is about what is being used now, though it had not been figured out for the present trip. A De Laval centrifugal purifier is used. Mr. Kobayashi says that no trouble has been experienced with the engines.

She carries an engine room staff of 21, while there are two extra engineers for instruction and a guarantee engineer on board. The engine room staff is made up of 8 engineers, including one electrician, 9 oilers, including an assistant electrician, one storekeeper and 3 wipers. A watch at sea consists of 2 engineers and 2 oilers. For maneuvering in port two watches are used.

There is a special adjustment on the fuel valve lift for running slow, it being possible to slow the engines down to 25 r.p.m. though 60 r.p.m. is the ordinary slow speed. It is said that the 180 hp. auxiliary air compressor for keeping up the pressure of starting air is not called upon, the compressors on the main engine, together with the three large air bottles, providing plenty of air for all purposes.

The consumption of fuel oil in port, working winches from 7 a.m. to 5 p.m. as well as other necessary auxiliaries, is said to be about 8 cwt. a day. Fuel for the engines is passed through settling tanks. A Cochrane vertical type donkey boiler provides steam, when necessary, for a small auxiliary air compressor and for steaming out tanks or heating the settling tanks.

Another Geared Motorship

With the delivery of the DUISBURG to the Deutsch-Australische D. S. Gesellschaft, the first practical test of the Vulcan hydraulic reduction gear in a big ship has begun. The DUISBURG is a vessel of 448 ft. x 58 ft. and carries 9500 tons d.w. on a total displacement of 14,370 tons. Her propelling machinery consists of two single-acting non-reversible 4-cycle M. A. N. engines of the 8-cylinder type turning at 215 r. p. m. and developing about 2000 b. hp. These two engines are connected with the hydraulic reduction gears which reduce the speed of the single propeller to 80 revolutions. Reversing is effected through the Vulcan gear. Five other freighters and a seagoing tug are being equipped with similar transmission.

Motorship Meat Carrier

Early last month the PORT HOBART, a twin screw motorship of 10,800 tons d.w. built for the service of the Commonwealth & Dominion Line between Australia and Great Britain completed her trials successfully and was taken over by the owners. She has a cruiser stern and a topgallant forecastle, which give her quite a distinct appearance. In length overall she measures 465 ft. x 59 ft. 6 in. and in depth molded to the upper deck 43 ft. 9 in. The PORT HOBART has five cargo holds, two of which are insulated. The total insulated cargo space is about 297,000 cu. ft. while that of the uninsulated cargo space is about 307,000 cu. ft. The insulated space is specially arranged for the carriage of chilled meat from Australia to New Zealand. The vessel has two masts and six derrick posts with eight 10-ton and six 7-ton derricks besides a 50-ton derrick. The main propelling machinery consists of two sets of 4-cylinder Doxford engines developing a total of about 4200 s.hp. at 95 r.p.m. The oil fuel is carried in No. 3 double bottom tank, in a tank under the main engines, underneath No. 4 hold, in the deep tank forward of the machinery space and in tanks in the engine-room. A duct keel is fitted forward of midships. All the deck auxiliaries are electrically driven, including the 14 cargo winches.

Northward to the Pole with an Oil Engine

Auxiliary Schooner Bowdoin Starts Under Power for the Arctic with MacMillan Expedition

ONCE more the fascination of the North has called Donald B. MacMillan and he has answered by sailing on his third Arctic expedition in the BOWDOIN, that staunch little ship which has served him so well on his previous explorations.

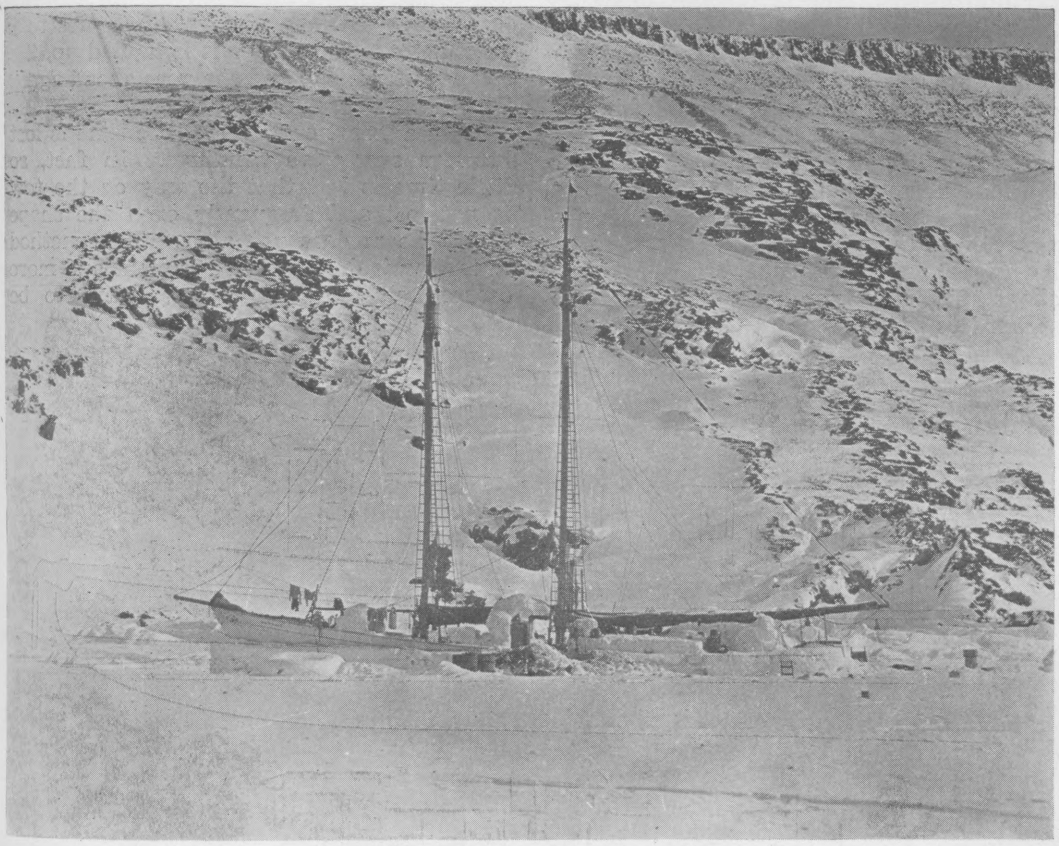
This expedition has quite a different object in view than was the case with his Baffin Land expedition of 1921-1922 and his North Greenland trip of 1924. This time MacMillan plans to fly to the Pole. The Navy Department is supplying three planes and the personnel to man them, and the expedition is under the auspices of the National Geographic Society.

One of the planes, carried in dismantled form on the deck of the BOWDOIN is designed for landing on either ice or open water. The other two planes are being transported fully assembled on a steamer accompanying the BOWDOIN. Barring untoward accidents the two vessels expect to reach Etah, their northernmost base, by August 1st. Etah is about 700 miles from the north Pole. Two of the planes will then hop to a base to be established perhaps 250 miles north of Etah. From this second base they will be at a point whence they expect to fly to the Pole and return.

The BOWDOIN is a trim little schooner of 66 tons gross, built of wood by Hodgson Bros. of East Boothbay, Maine, from designs by William H. Hand, Jr., and Dr. MacMillan. Her principal dimensions are as follows:

Length (o.a.)	87 ft. 1 in.
Breadth (md.)	21 ft. 0 in.
Draft	10 ft. 6 in.
Registered length	75.7 ft.
" breadth	20.2 ft.
" depth	9.4 ft.
Rig	Schooner
Auxiliary power	60 hp.

In her previous expeditions the BOWDOIN has given a very fine account of herself. The service is about as severe as can be imagined. As shown by the accompanying illustration, on one occasion she was forced clear of the water on to a ledge of rock by the ice. She was especially designed to lift clear of the ice under pressure and to navigate through narrow leads.

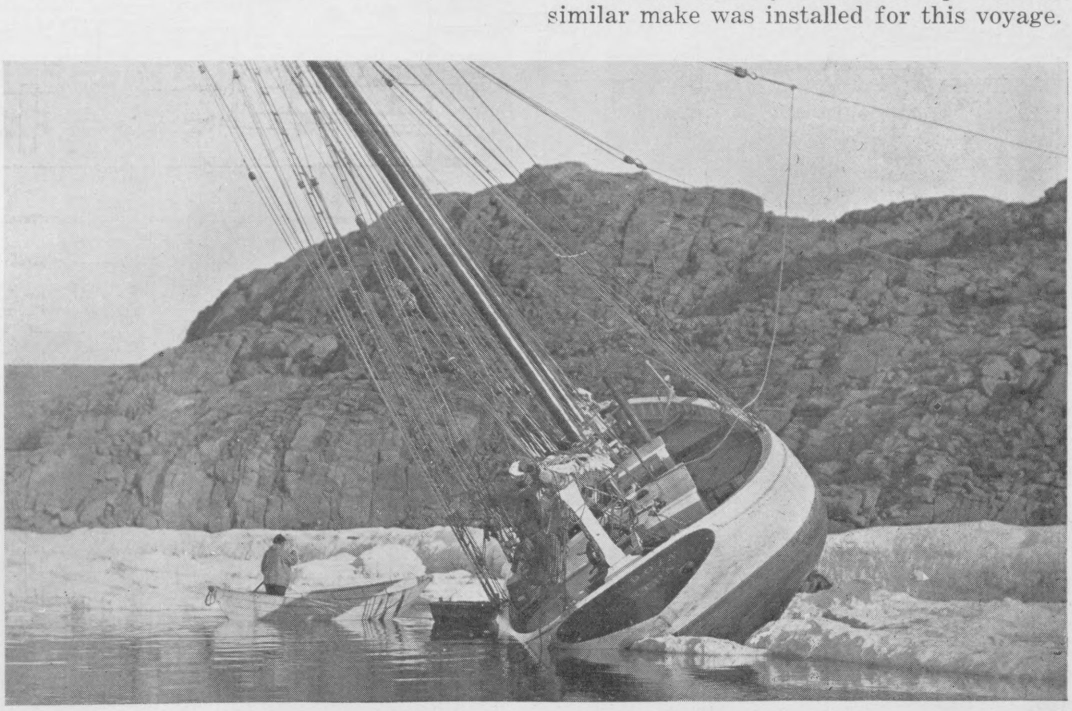


Where MacMillan's auxiliary schooner Bowdoin was frozen in for 330 days

At the time the engine was chosen for the BOWDOIN every possible form of power was considered, for the safety of the expedition was dependent on the reliability of the installation. The final selection of an oil engine for a hazardous voyage into the frozen north was a fine tribute to the reliability and suitability of this type of power. On the two first expeditions not the slightest difficulty was encountered with the oil engine.

After the first expedition Dr. MacMillan made an interesting comment on the reliability of oil engine power. "Naturally, following our long imprisonment of 274 days in the ice at 64 deg. north latitude," he stated, "during which time the BOWDOIN was frozen in the solid ice with temperatures as low as 60 below zero, Fahrenheit, I had grave doubts as to the engine starting readily when released from the pack on the first day of August. I also feared that due to such extreme cold certain parts of the mechanism might have been seriously injured through excessive contraction. We had simply drained the water off in the Fall and left the engine as she was without even taking off a cylinder head. We heated the plugs, turned on the air and she was off as if she had stopped the night before."

On the first two expeditions the BOWDOIN was equipped with a 45 hp. Fairbanks-Morse engine. For the present expedition it was decided that the ship needed a little more power, in order to keep up with the steamer. It was also felt that the increased power would enable her to still better cope with the ice and weather conditions. The operation of the 45 hp. unit was so satisfactory that a 60 hp. unit of similar make was installed for this voyage.



Bowdoin left almost dry on a ledge of ice in the Arctic

Oil-Engined Alligator or Winding Boat

Coosie, First of Her Type, Is Commissioned in Northern Quebec by a Big Pulpwood Company

AN interesting variant of ordinary towing is shown in the work of the COOSIE, a winding boat recently put into service on Lake St. John in Northern Quebec. She has been built for Price Bros. & Co. Ltd., one of Canada's largest pulp and paper concerns. In the country around Lake St. John, Price Bros. & Co. have large lumber tracks from which they are cutting to supply pulpwood in large quantities for their new mills at the head waters of the Saguenay River. The lumber can be delivered to Lake St. John by drives over the several large rivers emptying into the lake.

A number of special conditions conspired to render the problem of towing the logs across the lake an unusual one. Various shallow regions restricted the use of a large seagoing type of tug to certain areas, while the ordinary type of alligator or winding boat was neither sufficiently powerful nor seaworthy enough for the purpose, the lake being about 30 miles wide and 30 miles long and occasionally quite boisterous. There was the further consideration that, owing to the nature of the country and its limited resources for the accomplishment of mechanical work, the size of the boat had to be restricted to the capacity of railroad transportation, because Lake St. John is landlocked and inaccessible to navigation from outside.

What was finally evolved by Walter Lambert, the Montreal naval architect, was a steel boat 60 ft. long, 12 ft. 6 in. beam and 7 ft. molded depth. She represents the largest capacity of a boat restricted to flat car dimensions. She is thought to be the first oil-engined alligator yet built, and the service she will give will no doubt be closely scrutinized by the lumber industry because the boat promises to fill a need hitherto somewhat inadequately served.

For power purposes there is installed a 2-cylinder Kromhout oil engine of 100 b.hp. which can be connected either to the propeller or to the winding engine. When the boat is running free she has a speed of about 10½ miles per hour, on a draft restricted to 4½ ft.

The method of operation is for the boat to run free to a point ahead of her tow, according to the length of her winding hawser, which in this case consists of 7000 ft. of ¾ in. cable. She then drops a 1000 lb. anchor and goes back to her tow, paying out the winding hawser over the bow, at a speed of 10½ miles per hour. When she has returned to her tow she makes fast with a short stern line. The clutch of the winding engine is then engaged and she begins to wind in the hawser. In this way she winds herself up to her anchor, pulling her tow behind her. When she comes to a position over the anchor it is hauled up, the stern line is let go and she goes ahead again 7000 ft. to repeat the operation.

With a smart crew very little time is lost between successive windings. In fact, so little time is lost that the way on the tow is not lost and frequently even the shape of the boom does not alter. This method of towing is deemed more efficient and more economical when heavy tows have to be

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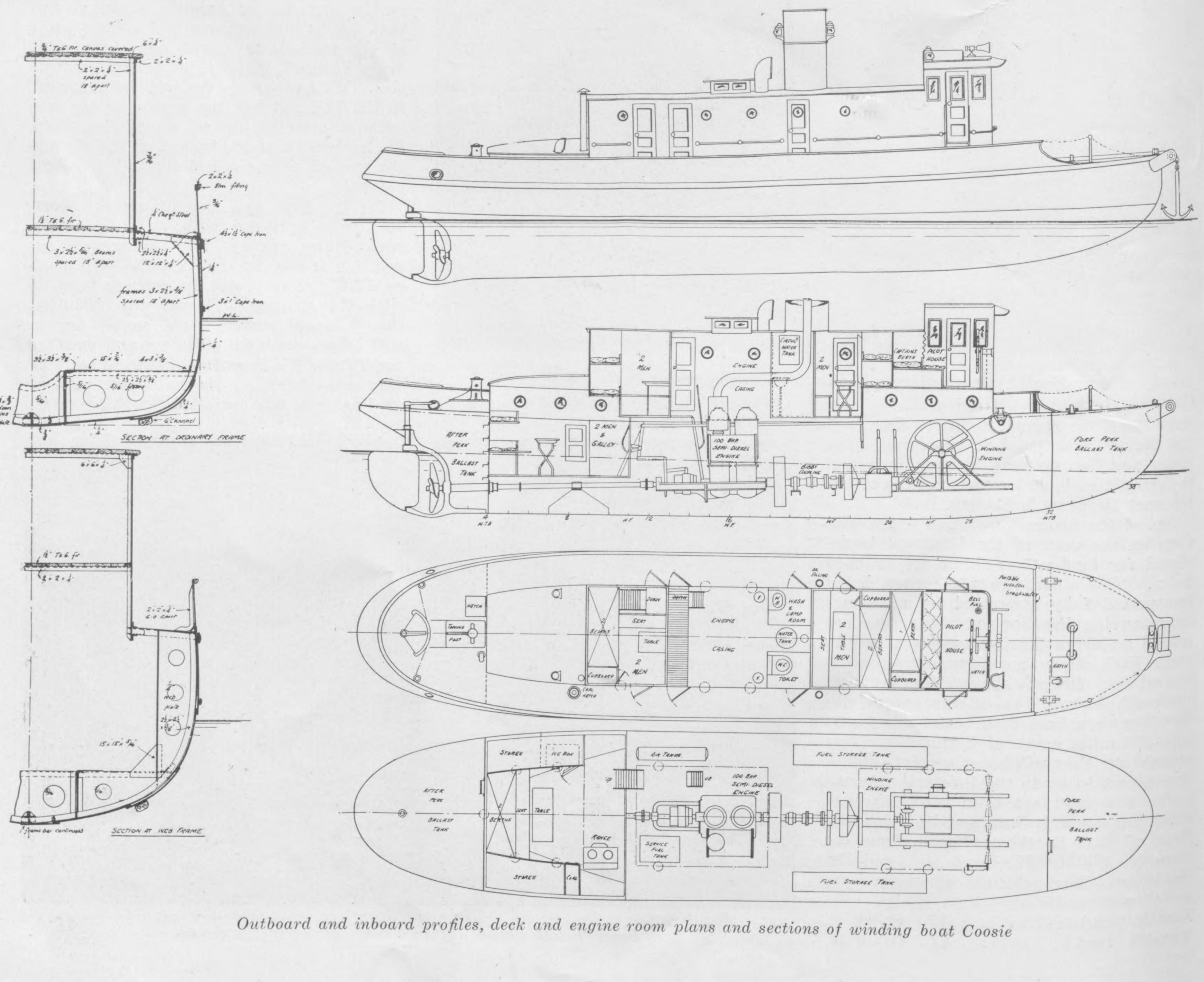
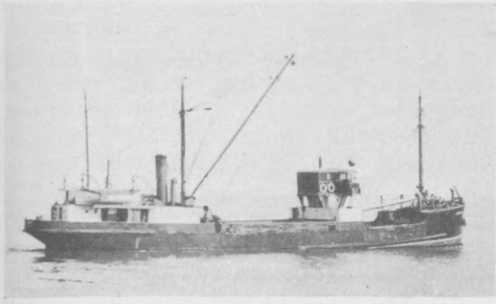


Outboard and inboard profiles, deck and engine room plans and sections of winding boat Coosie

Welded Motorship Caria Now Five Years Old

Brought Out to Pacific Coast from Scotland This Year and Engaged in Carrying Cement



Welded motorship Caria leaving Vancouver

CARIA is said to be the only welded vessel to have made an extended ocean voyage, having been brought out from the British Isles to the British Columbia coast this spring by the B. C. Cement Co., Ltd., of Victoria, B. C., to engage in their cement carrying trade.

Built by Cammell, Laird & Co. at Birkenhead in 1920 as an experiment in welded ship construction, she is said to have cost far more than the ordinary rivetted job, for various labor reasons in addition to the actual cost of the welding.

This form of construction has proved very strong under severe tests. CARIA is still as tight as a drum, the plates and framing, decks, bulwarks, hatch coamings and deckhouses being welded in one unbroken unit. Even the original winches appear to have been welded to the deck, though the present ones have been bolted down. The welding on the lapped plates and in other angles is a smooth job and looks like putty, though the butt-welded joints are a little rougher, nothing having been done to smooth them off.

CARIA is said to have been severely tested through getting ashore near Belfast, her bottom plates having been driven up as much as 1 ft. in places, though without starting any leaks. Repairs were made by heating and pressing back into shape without breaking any of the joints.

The first engine is said to have been a Fullagar 2-cylinder opposed piston engine of 500 hp. for experimental purposes, which was replaced in 1921 by a 4-cylinder 2-cycle Beardmore surface ignition engine, with 16½ in. cylinder diameter and 19 in. stroke, developing 320 b.hp. at 225 r.p.m. This engine is direct reversing by means of an air shuttle box operated off the main shaft. One generator is run off the main engine, and there is another driven by an auxiliary gas engine. An 8 hp. single cylinder oil engine runs the air compressor, which raises 300 lb. per sq. in. pressure in the starting air bottles. A pressure up to 150 lb. per sq. in. can be obtained in the starting bottles by tapping the compression in the main cylinders when the engine is running. The engine will start on 80 to 100 lb. per sq. in. pressure of starting air. A Cochrane oil-fired donkey boiler raises steam for winches, windass, capstan and donkey pumps.

Another view of Caria at Vancouver

A speed of 9½ knots is given on the ship's certificate of registry, but she is said to be normally operated at a speed of 8 knots at 200 r.p.m.

CARIA'S principal measurements are: length b.p. 150 ft., breadth 23.8 ft., depth 11.5 ft., length of engine room 35.5 ft., gross tonnage 419.92 and deadweight capacity about 400 tons. She is now registered at Victoria, B. C.

On the trip out from Leith to the British Columbia coast this spring, she made calls at Las Palmas, Trinidad, Balboa, and San Pedro; and maintained an average speed of 7½ knots at 190 r.p.m. throughout the long passage from Scotland to Vancouver.

Her fuel consumption is said to be 1⅛ tons a day at 8 knots (200 r.p.m.) and the lubricating oil 22 gal. a day for all purposes, including cylinder lubrication, thrust, shaft, auxiliary engine, bearings, etc. The fuel oil consumption at 225 r.p.m. is about 1¾ tons a day. CARIA left Scotland with an Anglo-Persian fuel of 28 deg. Beaumé. She is now commanded by Capt. Jas. Hunter, while Mr. Boomer, Chief Engineer, and Mr. Barclay, second, who came out to the B. C. coast in her, are in the engine room.

Oil-engined Alligator or Winding Boat

(*Continued from page* 588)

handled over shallow water for distances which are not very great. The reason for the superiority of this method is that when a heavy tow has to be handled at small power in a normal way by a propeller the propeller efficiency is exceedingly low, while in the case of the winding machine when the pull is on a heavy anchor there is no slip.

As one can see from the illustrations the winding engine and drum are installed forward. There are two speeds and a reverse control. This machinery is connected to the Kromhout engine through a Bibby flexible coupling. The winding gear was made in Ottawa, the coupling in England, the oil engine in Holland and the shafting and stern gear in Montreal. That these various parts were assembled for the first time at Lake St. John and operated right from the start without any control is a tribute to the care of those responsible for the job.

The vessel, which was only recently completed, is now operating 24 hours a day with a double crew. There are sleeping accommodations for seven men, toilet and wash rooms with running water and a galley. Fuel and stores are carried for two weeks' operation. On the winding engine this boat has towed 1,000,000 ft. of lumber. The hull was built by the Davie Shipbuilding Co. of Quebec to the design of Walter Lambert of Montreal, who also superintended the construction. Col. Johnson of Arnprior, Ont. who has long been associated with log twoing on the Ottawa River designed the winding gear and his initiative entered largely into the project.

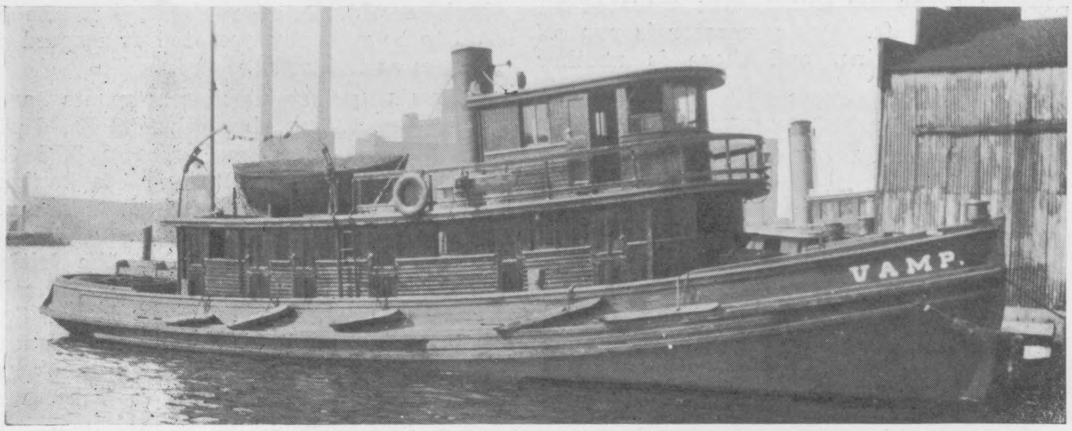
Winding boat Coosie just after her launching on Lake St. John, P. Q.

Motor and Steam Towboats Compared

A Lucky Break Was Responsible for the First Conversion of One of Our Tugs

By Roland V. Phillips*

On March 14, 1924, our steam tug MARIAN, 52 ft. long, 13 ft. beam and 7 ft. 6 in. molded depth, broke her shaft. Though we were trying to get some information on oil engines at that time, we had never gone into the matter of an installation or the conversion of one of our steam tugs to oil engine power. I suppose if it were not for the breaking of the shaft, we would not have installed the engine the MARIAN now has.



Second towboat of the Phillips fleet at Baltimore converted from steam

At the time she met with this accident we were figuring on having to stand the expense of renewing the shaft. By a strange coincidence, at the very time of this accident one of the oil engine companies was trying to effect a sale of an engine. We figured on a cost of $1,000 to renew the broken shaft, and after getting a price on the oil engine we decided to make the conversion and apply the cost of a new shaft and of the general overhauling of the steam plant to the purchase price of the new engine.

Naturally we were somewhat skeptical as to the claims made for the engine. Our steam engineers advised us against such a move, but our minds were made up. We signed a contract, junked the old steam machinery, made some repairs to the woodwork and ran a trial down the river on June 15th. The next day we started to work.

It is a pleasure to tell of the wonderful performance of this little tug. She has not lost one hour on account of engine trouble. She is always ready to work. The equipment consists of a 100 hp. Fairbanks, Morse engine, an independent air compressor and four 250-gal. fuel tanks.

The MARIAN now does heavier work in the harbor and travels farther away from port than she ever did as a steam tug. We have that confidence in her that we never had before. We always feel that she will get there. No boiler to give trouble, no fireman to growl and quit.

The greatest satisfaction is the economy effected. We save a fireman's pay, which is $27 per week or $1,404 for the year. The saving in the cost of fuel is amazing. To do the work as a steam tug would require 45 tons of coal at $5.10 per ton, 10 gal. of engine oil at $0.37 per gal., 1 gal. of cylinder oil at $0.50 per gal., and this makes a total cost of $233.70 for the month. The oil engine uses 1000 gal. of fuel oil at $0.0505 per gal., 1 bbl. of lubricating oil D. T. E. heavy medium at $0.65 per gal., 5 gal. gas at $0.20 per gal., $1.00 for extra heavy reverse gear oil and $1.00 for grease, making a total of $79.80 for the month. This shows a saving of $153.90 in one month for the fuel and $117 for the fireman's pay, making a total monthly saving of $270.90 or $3,250.80 for the year.

We also own and operate the motor tug VAMP, formerly the steam tug LIZZIE M. WALKER, 64 ft. long, 17 ft. 2 in. beam and 6 ft. 6 in. molded depth. We have installed a 150 hp. direct reversible Fairbanks, Morse engine. We have just completed the conversion, and figures on her performance are not available as yet. Naturally we expect the same satisfactory operation and the saving of oil operation over steam that we have had with the MARIAN.

She has the finest equipment of any tug her size in Baltimore. Her plant consists, in addition to the main engine, of the following: One 4 in. centrifugal wrecking pump, one 6 hp. engine, one 4½" x 4½" air compressor, one 1½ hp. light plant, eight 20" x 60" air tanks, one 1½" bilge and fire pump, two 800 gal. fuel tanks and one 120 gal. lubricating oil tank. The 6 hp. engine operates the air compressor and wrecking pump. The 1½ hp. engine operates the light plant and the bilge pump. She is 8 years old and was built at East Boston of extra heavy construction.

There is one other very favorable feature of the oil engine, and that is the low cost of repairs. In the motortug there is no boiler to give trouble. It has been our experience that, with some few minor repairs to the steam engine excepted, practically all of our troubles have been caused either directly or indirectly by the boiler. The cost of keeping a boiler in repair is very high, and every year for the Steamboat Inspectors, at annual inspection to comply with the law, we are compelled to submit to a cold water pressure which is very searching and many times makes repairs necessary. Thanks to the oil engine we are not subject to annual inspection. With the boiler there are pumps, condenser, feed lines and steam lines, etc., all causing many lost hours and days in the course of a year.

Marian, the tug that gave Mr. Phillips the lucky break

We own and operate five tugs. We have just converted the MARIAN and the VAMP, and it is our intention to convert in the near future our remaining three steam tugs to oil engine power.

Those who contend that on short voyages the motorship is not superior in economy to a steamship will watch with interest the operation of the little vessel URAMUS, 935 tons gross, just put into operation by Det Bergenske DS/AS, a Norwegian company. This little vessel, with dimensions 191 ft. x 30 ft. x 19 ft. 6 in., with a Polar engine of 700 hp. and electrically driven auxiliaries, has been put into the Norwegian coasting trade. A sister ship is under construction for the same owners. The adoption of electric auxiliaries in this class of trade shows a new line of progress.

*Member of the firm Vivian Phillips, towboat operators, Baltimore, Md.

Hugh O'Donnell, a converted tug with fuel capacity for the round trip between New York and Buffalo

Tug of 300 hp. for N. Y. State Barge Canal

Hugh O'Donnell More Powerful Than Any of the Motortugs Yet Used on the Canal

THERE is a tendency to increase the power of the towboats built for service on the New York State Barge Canal. In many of the earliest boats put into that service no more than 100 hp. was installed. Bigger ones followed with 150 hp. and 180 hp. Then the power was increased to 200 hp. and in a later example to 240 hp. Finally this has advanced to 300 hp. in the converted tug HUGH O'DONNELL which has been commissioned this summer.

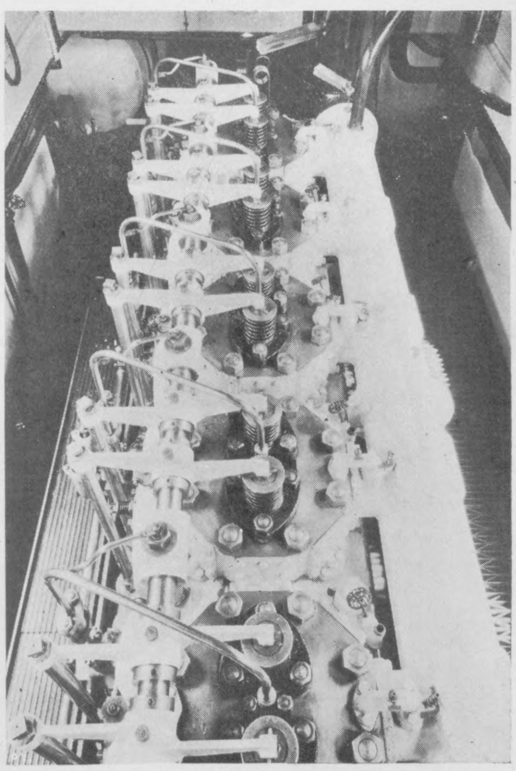
This power cannot be utilized to full advantage on the Canal, but it is a great benefit to the boat when she has to leave the Canal in the winter and find work in New York harbor, where a 300 hp. towboat has a far greater range of jobs to seek than can be undertaken by tugs of 250 hp. or less power.

In the conversion of the tug HUGH O'DONNELL there has been more than a mere change of machinery. In addition to the replacement of the steam plant by the oil engine, a considerable operating change has been rendered possible by an increase in the crew's accommodation so that the boat can be operated now with double shifts.

HUGH O'DONNELL is owned by the O'Donnell Towing & Transportation Company of New York City, and was formerly the JAMES M. BROOKS. She was built in 1920 at Milford, Del., and measures 72 tons gross on registered dimensions of 70 ft. x 20 ft. x 8.5 ft. Overall she is 77 ft. long.

After her conversion had been decided upon, she was sent to Bushey's shipyard, Brooklyn, where the steam machinery was removed. She was then towed to the Groton Works of the New London Ship & Engine Co. where the entire installation of main engine and equipment was made.

In order to fit her for work on the New York State Barge Canal she has been provided with sufficient fuel oil capacity to enable her to make the round trip from New York to Buffalo and back, thus effecting considerable economies in the elimination of bunkering en route. She has six tanks with a total capacity of 7500 gal. The two lubricating oil tanks carry 370 gal., and there is a fresh water supply of 500 gal. for drinking and washing.



Top view of engine in tug

The space formerly occupied by the boiler and coal bunkers has been utilized for the oil engine, and the old engineroom casing was removed so that extra cabins could be obtained for the crew. One of the new 300 s.hp. airless injection type of engines built by the New London Ship & Engine Company, has been installed weighing together with its thrust about 42,000 lb. All parts of the engine which do not have machine fittings have been painted white. With white fuel tanks and a white engine room casing, this produces the impression of a yacht's engine room. Such a remark addressed to the captain of the tug drew the scornful retort,—"Looks like a yacht? Why, she is a yacht!"

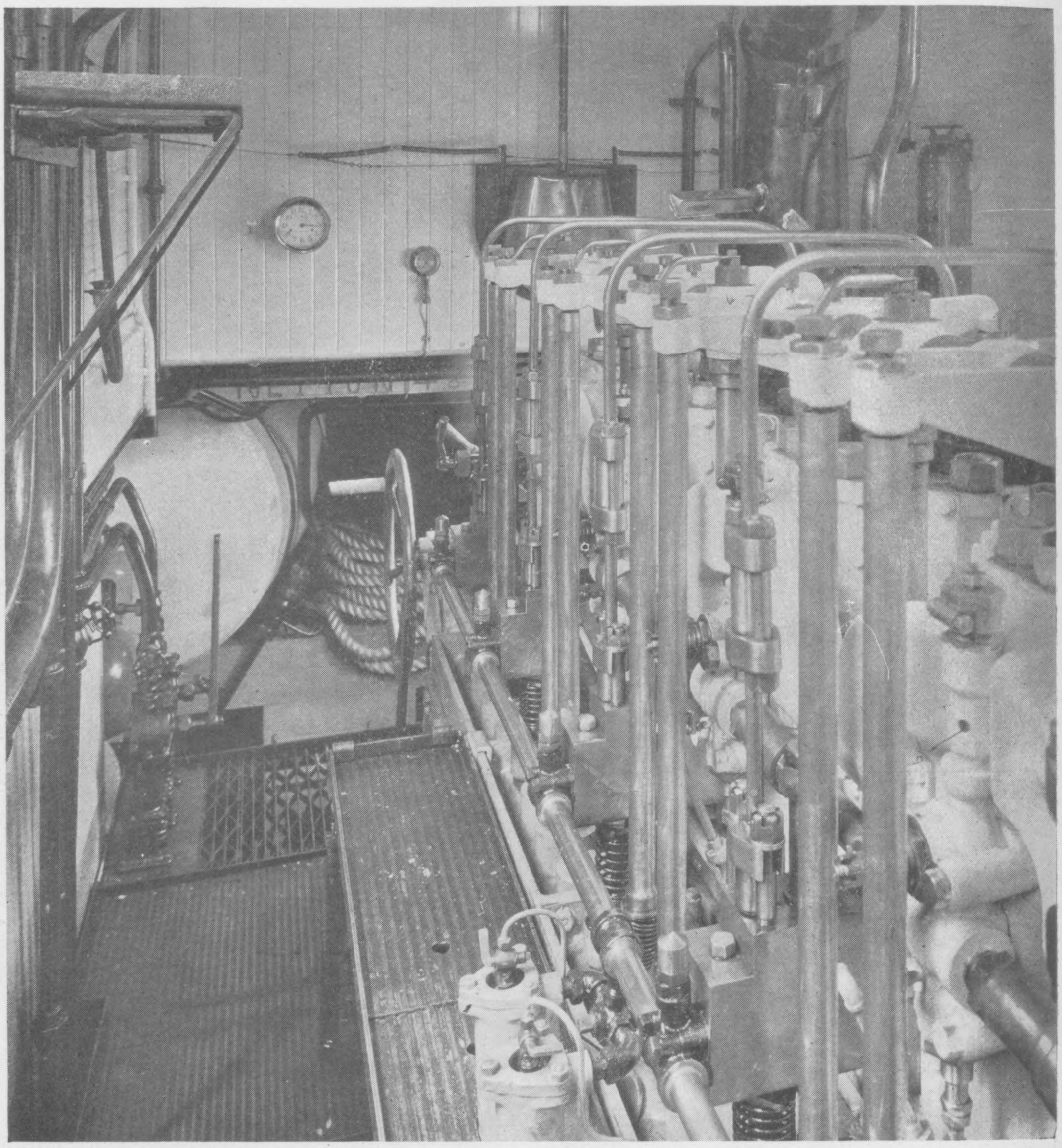
There is an auxiliary engine connected with an emergency air compressor for use in case all the starting air is lost or had to be released for inspection of the air bottles. Were it not also belted to a Goulds Pyramid fire and bilge pump, which can therefore be operated when the main engine is shut down, there would be good ground for the assertion that the installation of this auxiliary represents a needless expense. For a tug that will operate in New York in the winter and on the Barge Canal in the summer it surely would suffice to rely upon the resourcefulness of the engineers to obtain a charged bottle of compressed air without great delay in the extremely rare event that the starting air bottles were emptied. It would not be advisable to dispense with the auxiliary engine in the case of a tug operating in waters remote from modern industrial centers, but on the Hudson River and on the New York State Barge Canal one never is far from industrial centers.

With this type of engine there is of course no built-in compressor, and the supply of starting air has therefore to be obtained from an external source. For this purpose a Norwalk 3-stage air compressor is installed, driven through gears and a clutch from the tailshaft. It can supply per hour 30 cu. ft. at 1000 lb. per sq. in. which is sufficient for all maneuvering that the tug is likely to be called upon to make. When the starting air tanks are full and the tug not likely to be called upon to make many reverses, the clutch is disengaged and the compressor left idle. The fire and bilge pump previously mentioned as belted to the 9 hp. Venn Severin oil engine is also belted to the tailshaft, so that the auxiliary does not need to be operated when the main engine is running.

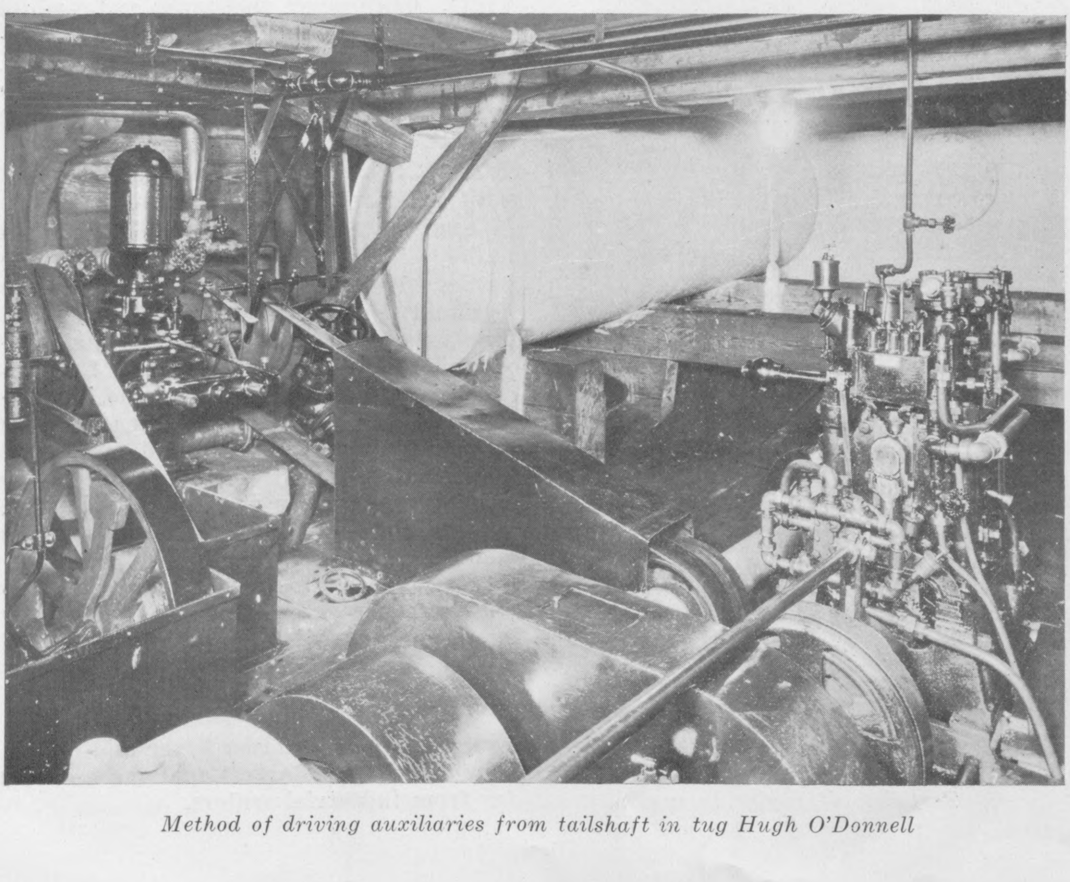
Current for lighting is obtained from a 1 kw. Kohler lighting set, and this also supplies power for a small fuel oil trimming pump set consisting of a Goulds centrifugal pump with a capacity of 75 g.p.m. driven by a 1/4 hp. Westinghouse motor. For filling the day tanks there is a Goulds columbia double cylinder force pump operated by hand, which works very effectively. An Arcola boiler is installed for heating the boat in cold weather.

The average fuel consumption of the engine being about 17 gal. per hour, which amounts to an hourly operating cost of about 95c at the present price of fuel oil, one is led to the expectation that this boat will effect a saving for the owner of between $12,000 and $15,000 per annum, regard being had to the fuel saving, to the elimination of firemen, and to the saving of time required for cooling and watering a steam tug.

This last item of water is often overlooked when comparing the costs of operating steamtugs and motortugs. In motortugs the cost of water is nil. In non-condensing steamtugs—and most of these boats are non-condensing—the cost of water is a big item. As an actual example may be mentioned the case of a railroad company's steamtug in New York harbor, the power of which is equivalent to about 250 s.hp. which uses more than $200 worth of water per month. For some obscure reason steamtug operators seldom add the cost of water to the cost of coal and lubricating oil when counting up their operating costs for comparison with motortug costs, yet it is a very big item and helps very greatly to offset the cost of conversion to motorpower.



Port side of engine and engineer's stand in tug Hugh O'Donnell



Method of driving auxiliaries from tailshaft in tug Hugh O'Donnell

A Florida Ferryboat

A new automobile ferryboat, FRED D. DOTY, has been put into service across Tampa Bay, Fla. between St. Petersburg and Piney Point. This ferry saves automobiles a road trip of 86 miles. The distance across the Bay by the boat route is seven miles. The ferryboat, which is built of steel, is flat bottomed and measures 104 ft. in length and 26 ft. in breadth. When carrying 18 automobiles she draws only 29 in. of water. She was built by the Tampa Dock Company, and is powered with two 75 hp. Kahlenberg engines, driving twin paddle wheels set on each side of the extended stern and of uncommon construction, to the design of Capt. F. D. Doty of New Orleans. The boat is stated to have made a speed of 11 miles an hour, and there is a report that the local ferry line plans to have two additional boats built soon of larger size, 135 ft. x 30 ft.

For the 200 vessels advertised by the Shipping Board for scrapping the highest bid was received from the Ford Motor Company which offered $1,760,000.

New Nelseco Engine Has Airless Injection

Latest Type M. A. N. 4-Cycle Trunk Piston Engine Is Produced by a Pioneer American Company

IN the tug HUGH O'DONNELL there has been installed the first of the American built M. A. N. airless injection engines of the type described in the July issue of MOTORSHIP. The HUGH O'DONNELL'S engine is a 6-cylinder set developing 300 s.hp. at 260 r.p.m. with a cylinder diameter of 12 in. and a piston stroke of 18 in.

It was built by the New London Ship & Engine Co. which had previously carried out a seven days' non-stop test run on a 3-cylinder 150 b.hp. engine of the same pattern. The type is now being put into production at the Groton works of the Company, and a series of 10 or 12 of these engines is already going through the shops. Three of these engines have been ordered for the Diesel electric vessel of the STEELMOTOR type which the Federal S. B. & D. D. Co. is now building for the U. S. Steel Products Co.

In all its chief details the design of the New London engine follows the practice which 32 years of development at the Augsburg plant in Germany has led to. Minor modifications have been introduced in order to render the design more suitable to American shop production methods, but these are not of a character to influence the performance of the engine. The one most noticeable to the eye when comparison is made between the German engine illustrated on page 526 of our last issue and the New London engine illustrated hereunder is the different disposition of the starting valves. The American engine also has a more practical arrangement of the controls. Other variations will be noticed.

In all the main features, however, there has been no departure from the Augsburg design. What this engine is capable of accomplishing appears from the summary of the 170-hour non-stop trial made on the 3-cylinder 150 b.hp. engine. During the whole of that period, extending from Wednesday of one week to Wednesday of the next week, readings were taken at intervals of one-half hour. The averages were:

Brake horsepower ....150.4 b.hp.
Revolutions per minute.........258 r.p.m.
Fuel consumption per b.hp. hr....0.405 lb.
Lubricating oil consumption per hr. ....0.09 gal.

Before the engine was shut down she was tested for governing qualities, and sudden changes from full load to no load were accomplished with practically no change in engine speed. Subsequently, in order to obtain a line on the accessibility of the engine the following parts were removed and laid out for inspection in less than one hour: cylinder head, inlet and exhaust valves, piston, wrist pin, upper and lower halves of main bearings, crankpin bearings and one fuel pump completely disassembled.

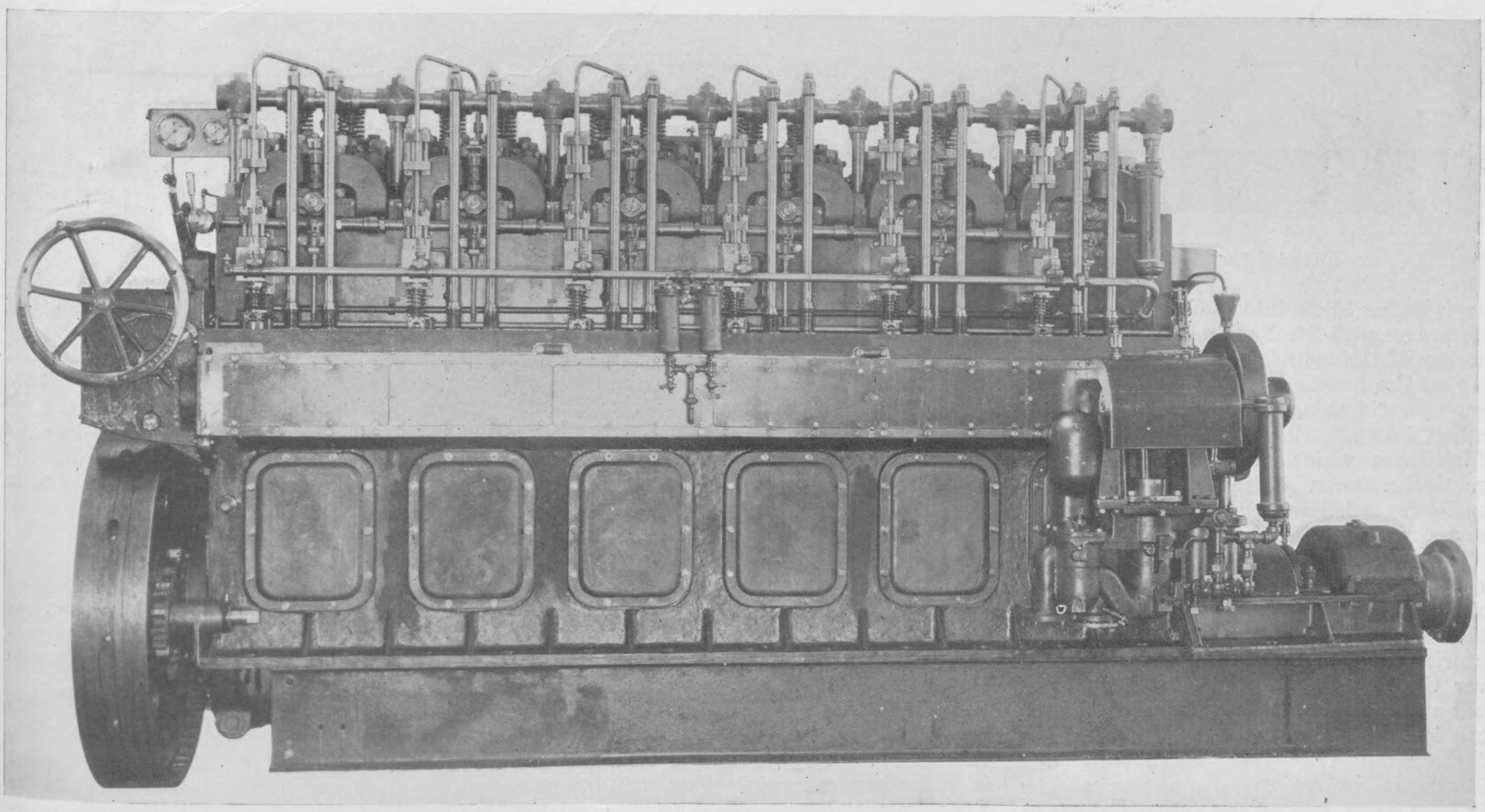
This 150 b.hp. engine direct connected to a generator on a single bedplate forms a very compact and efficient auxiliary set for motor vessels, and a number of them have already been ordered for this purpose.

Although the respective merits of air spray injection and airless injection are still a subject of controversy, few will disagree with the contention that for boats operating in harbors or on inland waters where supplies of ordinary Diesel oil are available the airless injection engines are preferable on account of their greater simplicity. That much may be admitted without regard to the other debatable elements that enter into the question of the use of airless injection on engines required to operate for long periods without interruption and on fuel oils of varying grades and gravities.

When to that advantage of simplicity is added a fuel economy of practically 0.4 lb. flat per b.hp.-hr. the airless injection type of engine has an added attraction. One knows that such economy is obtainable only with very efficient combustion, and efficient combustion in turn assures reduced costs of maintenance.

Any trunk piston engine bearing the Augsburg brand will function well and perform efficiently. One cannot forget that it was at the Augsburg plant that Dr. Diesel's crude mechanical interpretation of his invention was transformed into a commercial machine. When that was accomplished the Augsburg engineers did not rest, but sought continually for improvement. Even as far back as 1910, Diesel engine construction had become so standardized in the Augsburg works that none of the smaller engines were erected in the shops, but were assembled for the first time in the field.

Those same engineers developed high speed Diesel engines in a methodical manner, building fast running sets for direct connection to dynamos before they began to tackle the problem of the submarine en-



Camshaft side of 300 s.hp. airless injection engine of the M. A. N. type as built by the New London Ship & Engine Co.

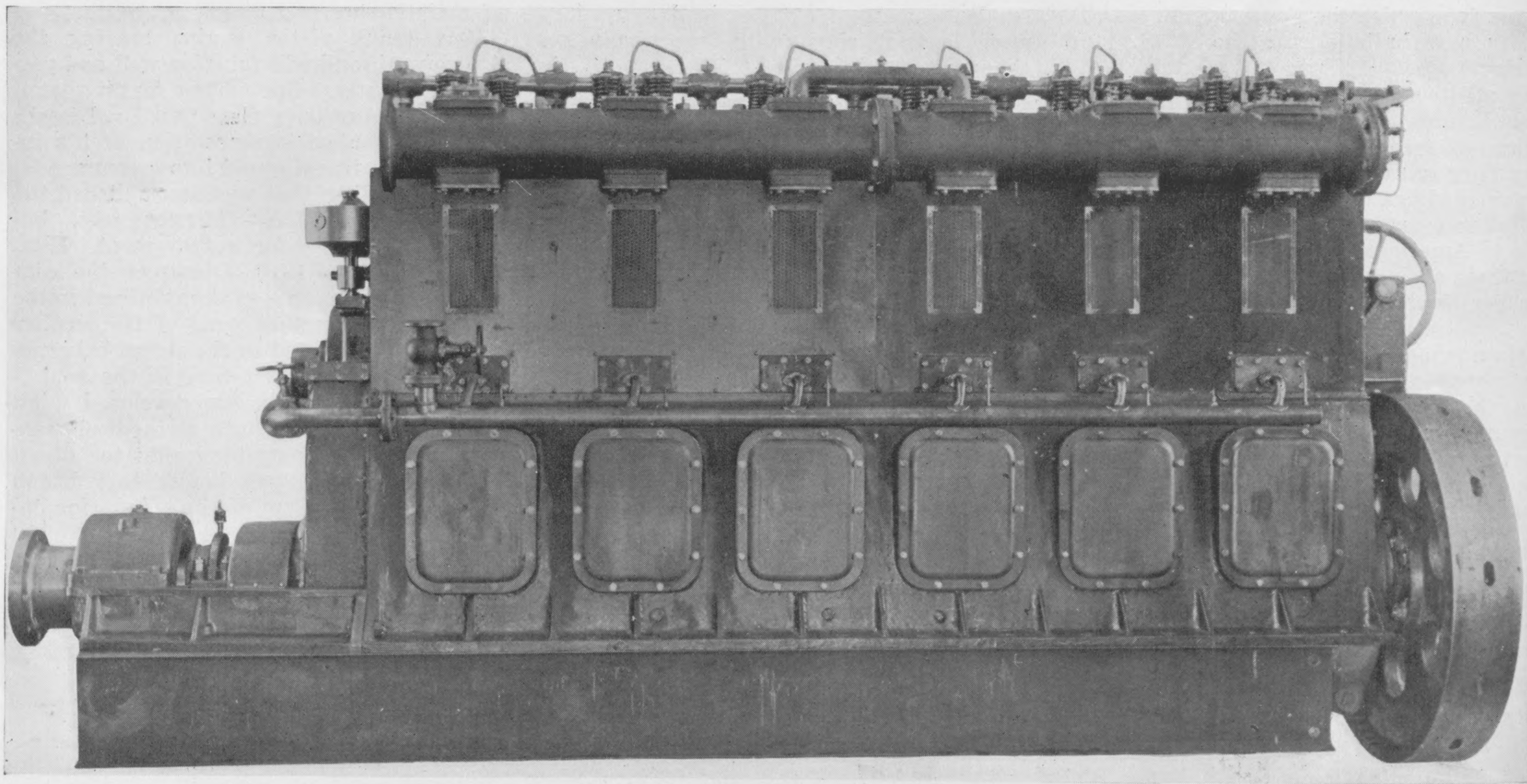
gines. Although the belief is generally held that the Augsburg factory did not build submarine engines before the outbreak of the European war, the contrary is true, and the development of the 3000 hp. Augsburg submarine engine, which is the outstanding achievement of all high speed Diesel engine work, was indeed just as gradual and methodical as all else that has been done at that plant.

A lot more could be written about the accomplishments there, but this eulogy will suffice to drive home the point that what is represented in the 300 hp. engine which the New London Company is now building is not just a new design, but the fruit of 33 years of patient, painstaking development by an organization that has never ceased to continue its researches into Diesel engine problems.

This New London engine has the single piece bedplate and engine frame, to which attention was drawn in the description of the German built engine in our last issue. Bedded on to that rigid base structure is in the center of the head. The rockers operating the inlet and exhaust valves are supported on a shaft carried in bearings mounted on top of the engine bolts, which makes a very neat arrangement. Only a couple of minutes are needed to shift these rockers out of the way so that the cylinder head can be removed.

The starting valve for each cylinder is in the side of the head in the New London engine, whereas it is on top in the German engine. The American rearrangement is more simple and does not seem to have been attained by the sacrifice of any good qualities in the cylinder head. The starting valves are operated from the side of the camshaft, and on top of the starting air valve chambers are mounted the cylinder relief valves. The air inlet elbows connecting the air space of the cylinder block with the inlet valve chambers in the cylinder heads are brought up back of the starting air valves and relief valve in a very workmanlike manner. The air suction is taken from the cylinder block, because the spaces ditional strainer of a very positive type in each high pressure line, in order to prevent any particles of dirt reaching the fuel sprays. The importance of these strainers resides in the fact that the fuel sprayer admits the oil to the cylinders through holes of such small diameter that they are almost invisible. Some engineers will take issue with the desirability of using such small holes, but these must be regarded as an inherent part of the Augsburg design and the remarkable fuel economy of the engine justifies them.

We questioned the engineers on the tug HUGH O'DONNELL about the cleaning of these fuel sprayers, and it was demonstrated to us that it is no trick at all to remove them from the cylinder heads and clean out the holes. If any minute particles of dirt get past the high pressure filters—and they must measure no more than half of 1/1000 in. in order to get by—they have to accumulate before they can cause any obstruction, and then they can be removed in a few minutes.



Back of the American built 300 *s.hp. M. A. N. type airless injection engine, showing breathers in cylinders*

the cylinder block into which the cylinder liners are set. Steel rods, extending from the top of the cylinder block to the underside of the bedplate in line with the main bearings, tie these two rigid castings together, thus affording the greatest measure of stiffness which can be obtained in a practical manner. This part of the design can be regarded as one of the greatest advances made in Diesel engine construction.

The cylinder heads are of a type which has frequently been illustrated in these columns because of the desirable cooling features incorporated in it. The water entering the head passes at high velocity over the surface subjected to the greatest heat and flows through the rest of the head at a lower speed. The picture of the top of the HUGH O'DONNELL engine on page 591 shows clearly the disposition of the air inlet valve and of the exhaust valve in symmetrical relation to the fuel spray valve around the water jackets in this block are well adapted to an arrangement of breathers along the back of the engine, which give a relatively quiet suction and enable the usual type of outside manifold to be dispensed with.

For the operation of the valve rockers and fuel pumps there is a camshaft at about the middle height of the engine, driven from the crankshaft by spur gearing. This camshaft is entirely enclosed and is lubricated from the main force feed system of the engine. Just above the camshaft housing and mounted on the outside of the cylinder block in line with each cylinder are the individual fuel pumps cut from solid chunks of steel and operating with plungers that need no packing. Each fuel pump can be separately adjusted, and is under governor control as well as under hand regulation. There are strainers ahead of the pumps, and there is an ad-

Reversing on this engine is accomplished by cutting off the fuel supply, shifting the camshaft by means of a hand wheel and giving a touch of air to the engine. There is an interlocking control between the reversing wheel and the starting air lever.

The captain of the tug put the engine through a number of maneuvering tests in order to demonstrate to us what a rapid response he could expect to get to his signals. The engine is very handy on the controls, and an emergency reversing signal sent through to the engine room when the engine was running full ahead afforded a severe test to which the engineer responded very creditably with his engine.

In the New London engine the controls are arranged on the operating side of the engine at the forward end, instead of being across the front end of the engine as in the German design. This arrangement is certainly suited to American conditions.

Latest Type Fiat Two-Cycle Engine

Tandem Design of Scavenge Air Pump and Compressor Is Used, and All Pumps Are Oversize

IN the engines of the m.s. MAULY, a vessel of 8000 tons d.w. built for the Cosulich line by the Cantiere Navale Triestino, the latest Fiat practice is exemplified. They are 4-cylinder 2-cycle sets developing 1250 s.hp. each at 115 r.p.m. and on the test floor have been run up to 1400 b.hp. at 122 revs. per min.

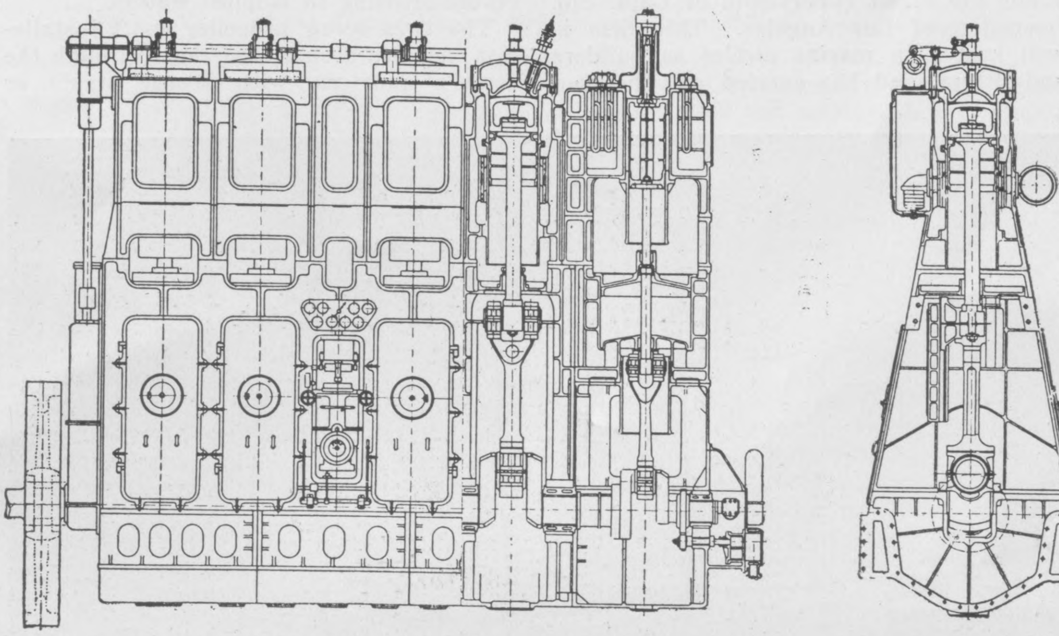
Each engine is entirely self-contained, driving its own air compressor, scavenge air pump, lubricating oil pump and cooling water pump, so that when the vessel is at sea no auxiliaries have to be kept running to assist in the operation of the main propelling engines.

On a bedplate which consists of four deep sections rigidly bolted together are erected the frames on which the cylinders are held. The frames are bolted together at about two-thirds of their height in order to provide stiffness. The cylinders also are built into a rigid block on top of the frame.

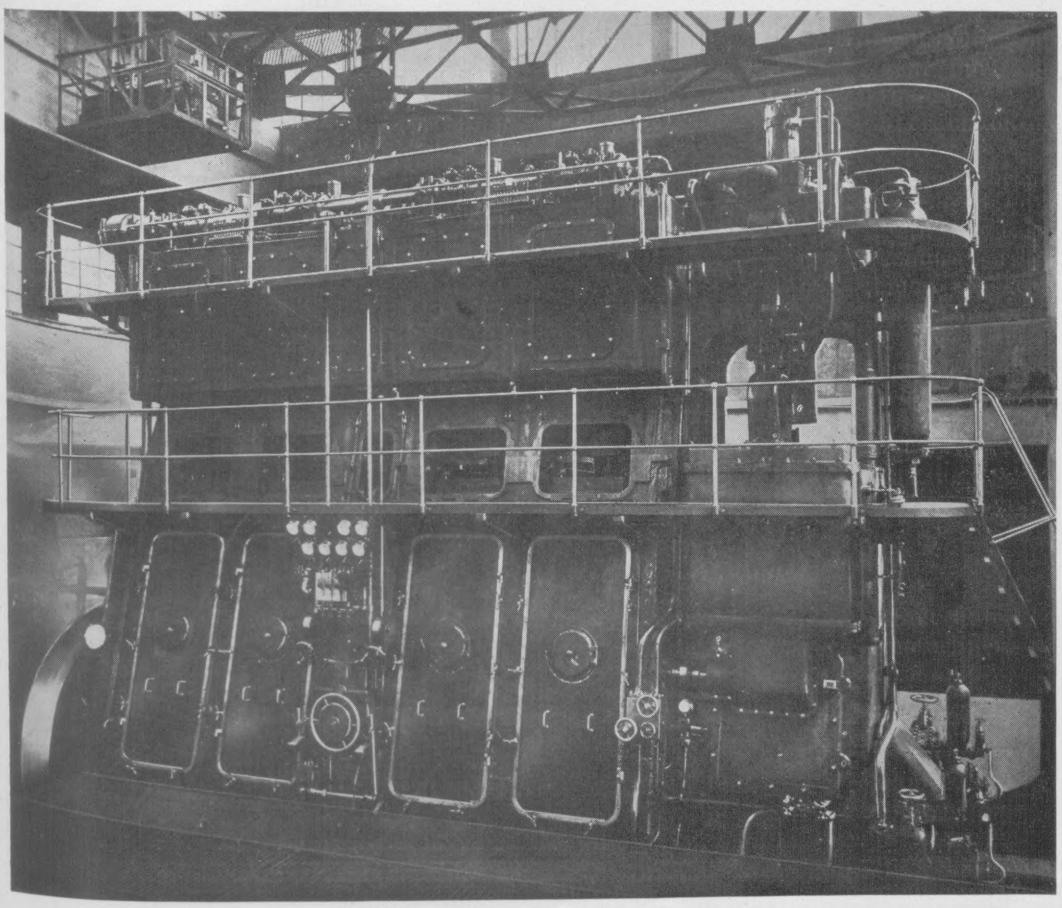
In this design of engine scavenging is effected on the port system, the air entering at one side and the exhaust being discharged from the other half of the circumference. The flow of scavenging air through the ports is controlled by automatic valves for each cylinder in the scavenge valve chamber. The scavenge pump is in tandem with the air compressor at the forward end of the engine. In the cylinder heads are only three valves, the fuel inlet valve, the starting valve and the safety valve. For the crankshaft three forgings are used, two sections consisting of two crankthrows each and the third being a single crankthrow for the scavenge air and compressor. Lubrication of the main bearings is effected by force feed, which supplies also oil for the big ends of the connecting rods and for the crosshead slippers. This oil is kept from contamination of burnt cylinder oil or of water by means of plates closing the upper part of the framing and through which the piston rods pass. The oil issuing from the bearings falls into deep crank pits and is drawn off there by the pump. The force feed is used also for the half-time gearing of the camshaft, the vertical drive of which is totally enclosed inside the engine framing.

A simple servomotor is used for reversing. It alters the timing of the camshaft and of the scavenge pump valves. At the engineers' stand there are, in addition to the control of the servomotor, also the controls for the fuel injection pumps, air compressor and starting.

At the forward end of the engine near the scavenge air pump and compressor drive are the lubricating oil pump and the cooling water pump, the former being a gear pump geared to the crankshaft and the latter a reciprocating pump driven by a crank on the end of the engine shaft. Only one cooling water pump is required, because the pistons as well as the cylinders and heads are cooled by salt water.



Elevation and sections of the Fiat 1250 s.hp. for the m.s. Mauly



Latest type Fiat engine of 1250 s.hp. with tandem compressor and scavenge pump

In the case of the MAULY engines the compressor, cooling water pump and oil pump of each engine are sufficiently big to take care of the needs of the twin engines if necessity should arise. Our Italian correspondent states that while he was at the works he had the opportunity of seeing a piston inspected in a few minutes, a piston taken down in half an hour and a cylinder casting replaced in eight hours, these operations having been timed for trial.

N. G. I. Motorliners

It is stated that the 31,000 tons passenger motorliner for the Navigazione Generale Italiana will be 706 ft. long o.a., 665 ft. b.p., 82 ft. 8 in. beam and 51 ft. 6 in. deep. Our Italian correspondent reports that the Diesel engines of 29,000 hp. are to be of the M. A. N. type and will be built by the Officine Savoia under license. It is further stated now that the N. G. I. will order two passenger motorliners of between 10,000 tons and 12,000 tons for its Central American service.

Conversion of Cargo Schooner to Yacht

Zane Grey Instals Auxiliary Oil Engines in His New 350-ton Yacht, the Fisherman

REMODELLED in 75 days from a cargo schooner to a luxurious up-to-date schooner yacht, the MARSHAL FOCH, now the FISHERMAN, is cruisng in southern waters with Zane Grey aboard.

Built in 1919 for Eba Garrett and later sold to Geldert and Smith, from whom it was purchased by Zane Grey, the ship has had the major part of her superstructure remodelled and modern fittings installed throughout, making her one of the trimmest pleasure crafts of her type afloat.

The remodelling was carried out by Smith and Rhuland of Lunenburg, N. S., under the direct supervision of Capt. Sid. Boerstler, of Los Angeles. This firm is well known in marine circles as builders and fitters, and has carried out the conversion in a creditable manner. The old time bunks have been replaced by cots, and electric fans and hot and cold water have been installed in all the white enameled staterooms. Amidships on deck are the officers' quarters and salon, fitted with equipment making for efficiency and comfort. The crew's quarters and galley are forward, while below decks are 16 staterooms and 5 bedrooms.

The vessel, which is of 350 tons gross, measuring 150 ft. overall with a beam of 35 ft., recently had its bottom covered with copper sheathing, which is necessary before cruising in tropical waters.

The twin screw propeller shaft installation includes bronze shaft logs through the vessel's quarters, with bronze struts or brackets, solid bronze tailshafts with wearing sleeves and Hyde propellers of the 3-bladed type.

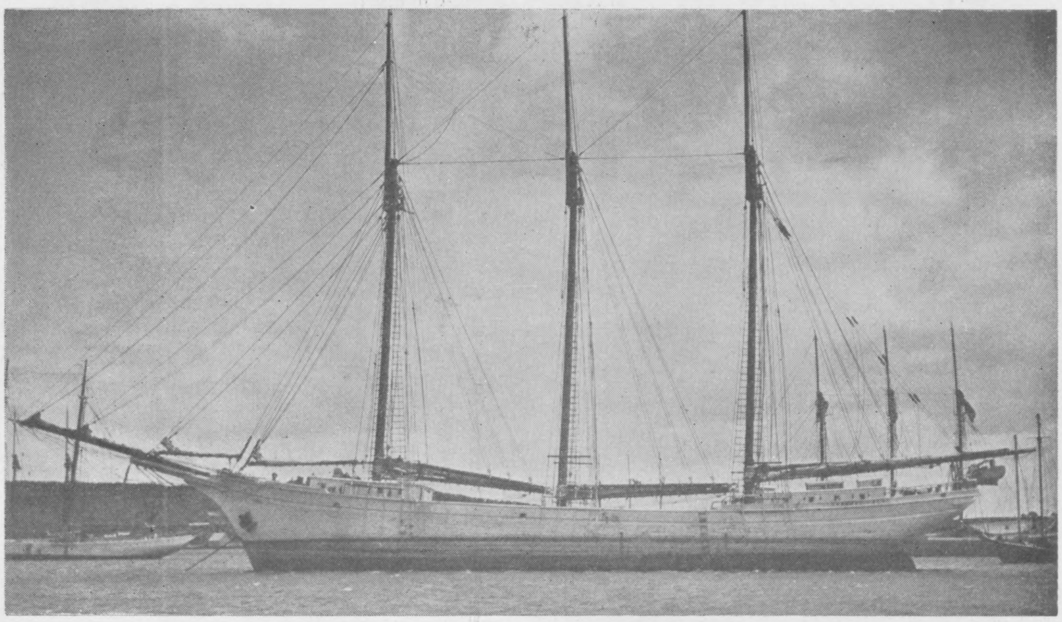
The engine room is most complete and convenient, twin 60 hp. Fairbanks Morse engines of the 4-cylinder type being used to furnish the driving power. The auxiliaries include a 10 hp. Fairbanks Morse engine, operating a 110 volt F. M. generator and also connected to a line shaft for driving other machinery. The generator is used for charging the lighting plant batteries and also provides power for the motor driven 3 in. by 3 in. Typhoon bilge pump, which is so connected that it can be used for circulating purposes with the ice machine or for pumping either salt or fresh water to supplement the running water supply if required. The ice machine or ammonia compressor with circulating pump used in conjunction, is driven from the line shaft by a friction clutch pulley.

A 3 hp. gas engine can be connected at any time to the line shaft for operating the ice machine or generator in case of trouble with the 10 hp. engine. This engine will also be used for operating the compressor for emergency air supply.

During the voyage from Lunenburg, N. S., to Santiago de Cuba, the main engines were run 94 hours and drove the boat at 7 knots. During the rest of the time the boat was under sail.

The vessel is now on a cruise which will take her to Los Angeles via the Cocoa Isles, Galapagos, and the Gulf of California. A moving picture party is on board, and the boat is equipment with all the necessary fittings for the developing and projecting of films.

Seven fishing launches are carried on deck, one twin-screw 32 ft. and another 25 ft., with five smaller boats, all equipped with engines.



Zane Grey's yacht, the Fisherman, a converted Canadian freight schooner

Big Air Tank Order

In the distribution of the orders for the starting air tanks required on the 14 vessels which the Emergency Fleet Corporation is converting to Diesel power, part of the business was placed on the Pacific Coast. The Moore Drydock Co. of Oakland, Cal., received an order for four tanks of 550 cu. ft. capacity at a price of $2,138 each. The order for the remaining 14 tanks of this size was entrusted to the Newport News S. B. & D. D. Co. at a price of $1,850 for the first tanks and $1,675 each for the 13 additional tanks. The difference in these prices seems to indicate that it is the intention of the Emergency Fleet Corp. to carry out the conversion of two of these vessels on the Pacific Coast, the remainder being split between Atlantic and Gulf yards.

These are big heavy tanks measuring 20 ft. overall and with a diameter of 6 ft. On account of the heavy lift charges that would be incurred in shipping them, the difference in price between the lowest Atlantic Coast bid and the lowest Pacific Coast bid was probably less than the total cost of shipment from coast to coast.

The New York Shipbuilding Corp. got the contract for the eight bigger tanks of 635 cu. ft. which, like the smaller tanks, are of 6 ft. diameter, but 22 ft. 6 in. long.

$350,000 Winch Order

Award has been made to the Lidgerwood Manufacturing Company of the Shipping Board contract for the winches to be installed on the government vessels now being converted to Diesel propulsion. On each vessel there will be ten cargo winches and one warping winch, making a total of 140 cargo winches and 14 warping winches. The performance required by the winches was stated on page 534 of our last issue.

For this equipment the Lidgerwood Manufacturing Company had quoted $795 for each cargo winch and $1129 for each warping winch. The total value of the contract was $127,106.

The order for the motors and controls for this equipment was placed with the Westinghouse Electric & Manufacturing Company at a total price of $188,722 and the shunt brakes were awarded to the Cutler Hammer Company at a price of $34,535.

How thoroughly the Shipping Board has absorbed the advantages of Diesel propulsion was again demonstrated when it issued its advertisement offering for sale 200 laid up steel vessels for dismantling and scrapping. The following clause was incorporated in the advertisement: "If any buyers of vessels for dismantling and scrapping shall make, prior to the scrapping of any of the vessels, a proposal satisfactory to the United States Shipping Board to convert any of said ships to Diesel propulsion in American yards with machinery of American manufacture, the Board reserves the right to enter into an agreement accepting such proposal in lieu of the obligation to scrap and dismantle said vessels, and this condition may be incorporated in all contracts and/or bills of sale."

Seattle Patrol Boat

Prompted by the experience of other cities with the Diesel marine engine, the harbor department of Seattle has converted one of its veteran patrol boats, the PATROL NO. 1, to Diesel power. This vessel has been operating several months now, and so pleased are her operators with the installation that they are already considering the conversion of one of their other patrol boats. PATROL NO. 1 is a 55 ft. craft, heavily constructed, and has a beam of 14 ft. and a draft of 5 ft. She was built in 1917 by the Marine Iron Works from designs by Capt. John C. Beck of the harbor department and was originally powered with a gasoline engine. About four months ago she was reconditioned, and a 4-cylinder 70-80 hp. Mianus Diesel engine installed, together with a Mianus air compressor direct connected to a 4 hp. Mianus gas engine. Since her conversion she has been operating regularly.

Patrol No. 1, of the Seattle Harbor Department, demonstrating her fire pumps

Tacoma ferry Wollochet recently placed in service

Automobile Ferry Wollochet

During the past few years there has been a considerable expansion in the use of oil powered automobile ferries on Puget Sound. The greatly increased automobile tourist travel in that locality, combined with the completion of fine highway systems around all parts of the Sound, has brought about conditions very favorable to the use of this type of vessel. There are now over a score of these craft plying on Puget Sound alone, while British Columbia has as many more.

One of the latest additions to the automobile ferry fleet is the motor ferry WOLLOCHET recently completed by the Skansie yards at Gig Harbor. This boat is 100 ft. long and is driven by a 150 hp. Fairbanks Morse engine. She is operated on a daily schedule from Tacoma to Wollochet Bay.

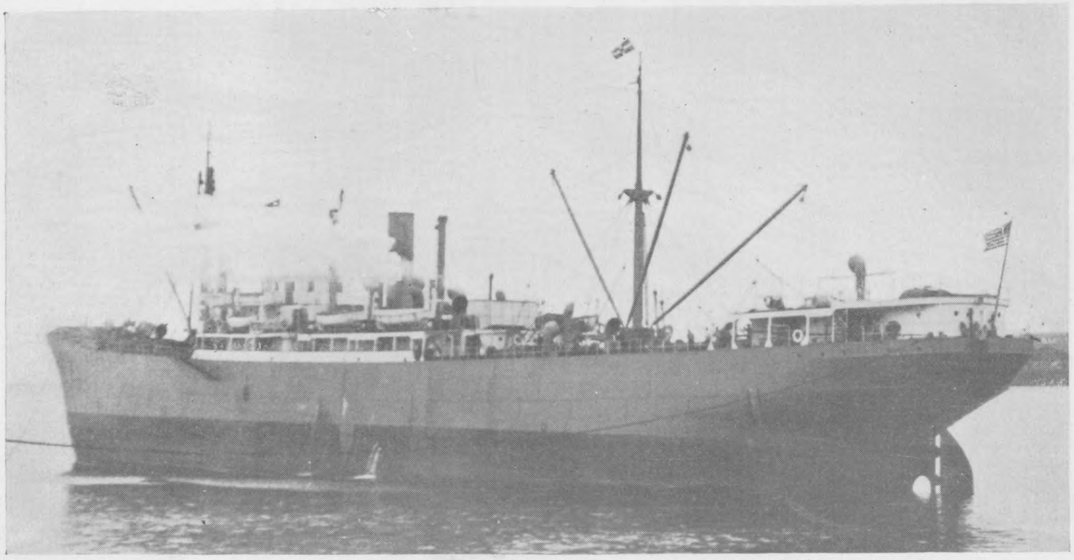
Towing Across the Bar

An interesting type of towboat, designed and built for a specialized service is now operating on the Oregon Coast for the Cary Davis Tug Co. DODECA, as the vessel has been christened, is 65 ft. long overall, by 18 ft. beam and 5 ft. draft, and is a raised deck type of vessel with a long deckhouse and high bulwarks aft. Her power plant consists of twin 80 hp. Western Enterprise engines.

She is being used to tow logs across the bar of the Siletz River in Oregon, the rafts being then picked up by the Cary Davis tug DOUGLAS. In order to enable her to withstand the heavy strains encountered in crossing the river bar, the construction throughout has been made unusually strong, and the bilges are notably flat to enable her to rest evenly on the sand bars in case of running aground. Instead of the struts customarily used in a twin installation, there are two shaft logs and two stern posts, the design of the underwater body aft being somewhat of a semi-tunnel. Two rudders also are used.

The crew's quarters are forward under the raised deck and accommodate two men. In the deck house are the pilot house, captain's cabin, wireless room and toilet. The accommodations in the deck house are so arranged that the steersman can have a clear view aft. A large towing machine is installed on the after deck, this machine being driven off the starboard engine.

Cary-Davis towboat Dodeca built for towing logs across a bar



M.s. Challenger moving into her berth at a Pacific Coast port

Challenger Making Records

CHALLENGER, owned by the Sun Shipbuilding Co. and chartered to the Isthmian Line, on a run from United Kingdom ports to the Atlantic and Pacific Coasts of North America as far as Vancouver, B. C., is proving the value of steamship conversion. This big single screw freighter of 11,850 d.w. tons is now equipped with a 4-cylinder Sun-Doxford engine of 3200 i.hp. using mechanical fuel injection. Her winches, windlass and other auxiliary machinery are electrically driven.

On her last voyage from the Atlantic to the Pacific coast with a heavy cargo giving the vessel a draft of 30 ft., her officers reported having made an average speed of 10.88 knots between New York and Los Angeles, the engines developing 3180 i.hp. at 82 r.p.m. on an average consumption of 12 tons of fuel a day. Between San Francisco and Seattle, after the ship had been lightened by the discharge of a large part of the cargo, an average speed of 11.5 knots is said to have been maintained.

They also reported having unloaded 5000 tons of raw sugar at Philadelphia in April last, at what is claimed to be a record for low cost of fuel used for handling, namely, about four mills per ton. The unloading was done during Sunday and Sunday night, finishing at 8 o'clock Monday morning.

CHALLENGER'S auxiliary machinery consists of three 2-cylinder, 2-cycle 100 b.hp. Worthington engines direct connected to 65 kw. generators. Two auxiliaries are kept running when working cargo. She has American Engineering Co's. winches with Westinghouse electric motors, good for 2-ton and 3-ton lifts on a single lead in high gear, which has proved very suitable for rapid cargo handling. For heavier lifts the purchase is increased as required.

Mahoe Superior to Maoi

A COMPARISON between the passage of the big oceangoing motortug MAHOE from Seattle to Honolulu and of the big steam tug MAOI which took a similar tow to Honolulu at about the same time furnishes another interesting proof of the superiority of the oil engine in this class of vessel.

MAHOE, which was described in the last number of MOTORSHIP, is 120 ft. long and powered with twin 360 hp. Diesel engines. At Seattle the machinery was given a six hours' dock trial, and the tug had a three hours' speed trial before starting on the long trip of 2435 miles to Honolulu towing a scow measuring 120 ft. by 40 ft. The passage was made in 14½ days on a consumption of less than 9000 gal. of fuel.

One week later the steam tug MAOI, which was reconditioned in New York early this spring, left Seattle towing the old schooner HELENE which has had her masts unstepped and been converted into a barge.

MAOI is 150 ft. long o.a., 27 ft. 6 in. beam, draws 14 ft. 1 in. forward and 15 ft. 9 in. aft. Her steam engine is rated at 800 hp. with 180 lb. boiler pressure and is said to be good for 1000 hp. She made the passage to Honolulu in 13 days, consuming a total of 42,000 gal. of fuel oil.

With oil costing 4 cents a gallon the fuel bill of the MAOI was $1,680 for the passage, in contrast with $450 for the MAHOE. There was also a saving in the labor cost of operation because, whereas the MAOI had a chief and two assistants with oilers and firemen, the MAHOE had only two engineers and two oilers. Probably if the MAHOE had had as good weather as the MAOI she could have saved 1½ days on her passage and reached Honolulu in the same time as the steam tug.

During the first ten days out from Seattle the MAHOE met quite heavy weather and having a square type wooden scow in tow, which is not a seagoing barge, she had to reduce her speed. The steam tug left the day following and ran into the same weather, but turned back to Seattle and did not leave again until several days later. The barge she was towing was of the schooner type and much easier to tow. The difference in the weather conditions and in the nature of the tow emphasizes the superiority of the motortug.

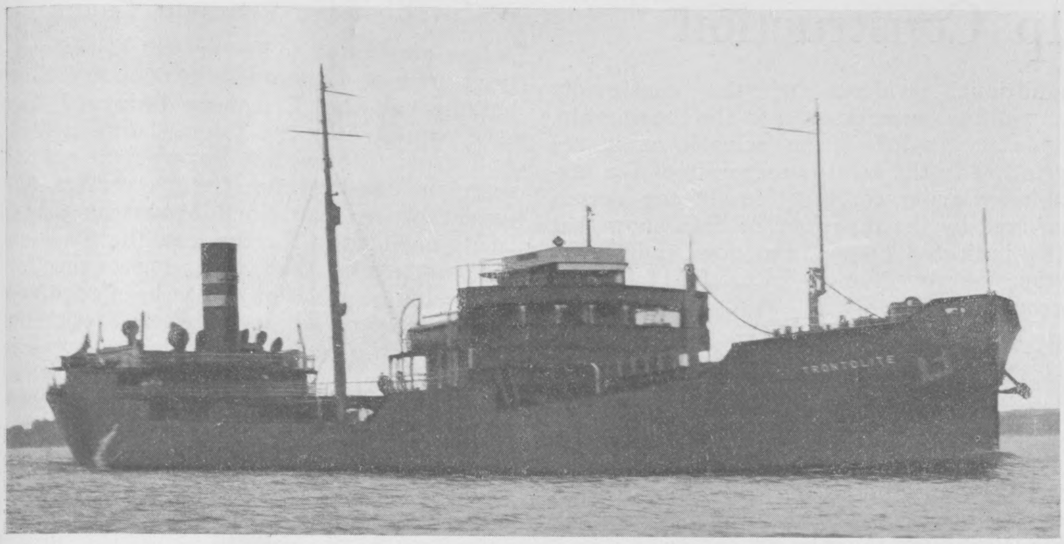
Propeller of J. W. Van Dyke

Dr. S. E. Slocum who designed the propeller of the J. W. VAN DYKE, the 7500 tons d. w. c. converted tankship of the Atlantic Refining Company, calls attention to the fact that the propeller diameter was wrongly given in all cases where it was mentioned in the descriptions of this ship which have appeared throughout the country. The diameter is actually 15 ft. 6 in. instead of 12 ft. 6 in. as previously published. The statement that this propeller has a variable pitch may possibly be misinterpreted. It is better to state that the pitch is varying, the blade contour and cross sections being designed in accordance with principles derived from the circulation theory of propeller action, which is the basis of all the propellers studied out by Dr. Slocum. The term variable pitch may be held to mean that the pitch can be altered, which is true of course of all sectional wheels in which the studs pass through slotted holes in the pad for adjustment.

An International Ferry

In the illustration of the ferryboat LUBEC at her Eastport wharf an impression is conveyed of the remarkably high and low tides, reaching about 28 ft. at this border island city. At high water the passengers step off the main deck of the LUBEC directly to the top of the pier. In the distance, 1½ miles, is the Canadian island of Campobello, N. B., where the ferryboat has made daily landings for more than a quarter of a century. The ferry line across the international boundary harbor has been in commission over 35 years. Originally equipped with a steam boiler, the LUBEC was built in 1891 in Portland, and her dimensions are: length 70 ft., beam 23 ft., draft 5 ft. In 1918 she was purchased by Ralph Hindley of Darien, Conn., who took over the entire property of the Passamaquoddy Ferry Co. In the previous year when the craft had been repaired at a cost of $12,000 a new Diesel engine of 100 hp. had been installed, making 350 r. p. m. This engine consumes 70 to 80 gal. of oil daily on the several round trips between Eastport and Lubec, a distance of 3 miles direct, but with stops occasionally at North Lubec and Campobello Island, New Brunswick, entailing a round trip of about 8 miles. Five round trips are made on the average. The ferryboat can carry 300 passengers in addition to general freight, and had the U. S. mail contract between Lubec and Eastport, two round trips daily, up to July 1st., which amounted to $1800 a year for 4 years. The speed of the LUBEC is about 10 knots.

Ferryboat Lubec of Eastport, Me.

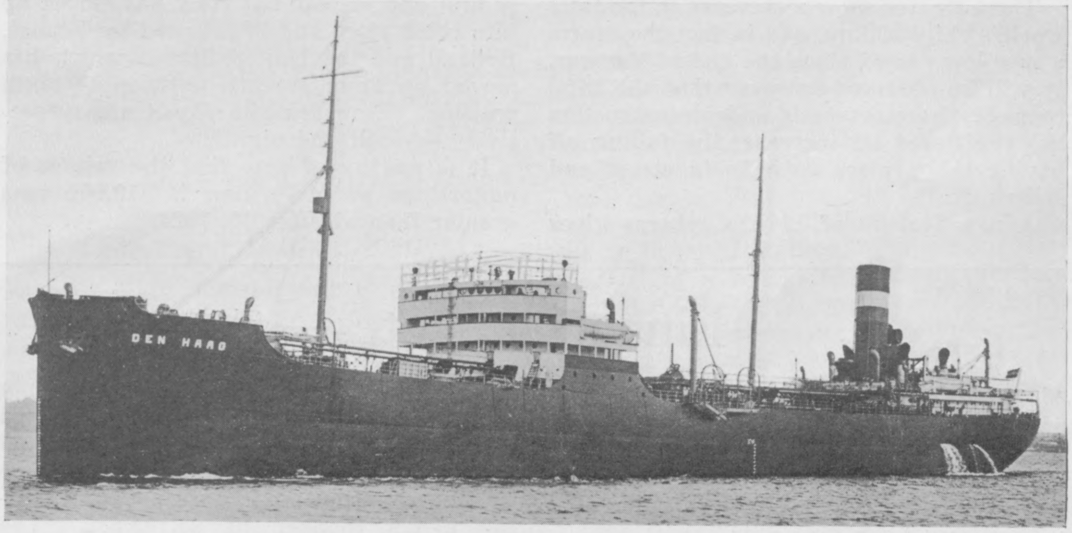


Converted oil tanker Trontolite of the Imperial Oil Co. of Canada

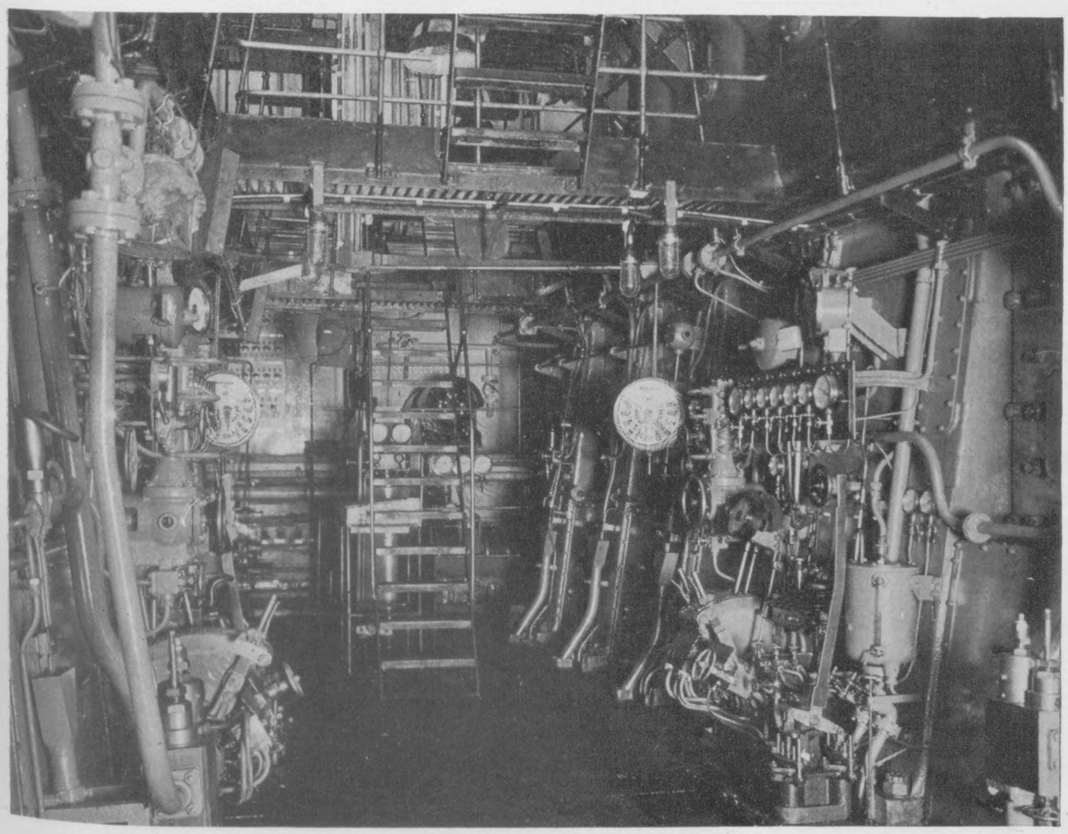
New Dutch Tankers

About the middle of last month DEN HAAG, a new motorship belonging to the Petroleum Industrie Maatschappij Haag, a Dutch company, brought her first cargo of oil into New York. She has been built by Krupp's and is a twin screw boat of about 12,000 tons d.w., a sister ship to the PERSEPHONE recently completed for the Deutsch-Americanische Petroleum Ges. Her measurements are 450 ft. length b.p., 63 ft. molded breadth and 35 ft. 6 in. molded depth to the shelter deck. DEN HAAG is propelled by two 4-cycle 6-cylinder engines developing 1400 s.hp. each at 125 r.p.m., but her sister ship has two 4-cylinder 2-cycle sets rated at 1430 s.hp. at 90 r.p.m. and capable of giving 1600 s.hp. maximum, the engines in both cases being of Krupp construction.

KATENDRECHT is the name of a new motor tanker recently completed in Holland, to the order of the N. V. Stoomvaart Mij. De Maas. Her principal dimensions are 370 ft x 53 ft. x 28 ft. and her deadweight capacity is about 6500 tons. She is a single screw vessel driven by a 6-cylinder, 2-cycle M. A. N. single-acting engine which develops about 1850 s.hp. at 100 r.p.m., built by the Fijenoord firm of Rotterdam.



New twin screw motor tankship of about 12,000 tons and 2800 s.hp.



Control stands of the twin screw engines of the new motor tankship Den Haag

Converted Canadian Tanker

For the Imperial Oil Co. of Toronto, Canada, the tankship TRONTOLITE has just been converted from steam to motor power. She is a vessel of 419.5 ft. registered length, 57.2 ft. breadth and 29.8 ft. depth, of 6883 tons gross and about 9550 tons d.w.c. Built by the Skinner & Eddy Corp. in Seattle, she was equipped with a steam turbine. Krupp's carried out the conversion at Kiel and installed a 2-cycle, 6-cylinder engine rated at 2150 s.hp. at 90 r.p.m. This is the same size engine used in the conversion of the S. V. HARKNESS and illustrated on page 519 of our last issue. The power was given as 2400 s.hp. in the case of the S. V. HARKNESS, but it is now made clear that the higher figure represents the approximate maximum horsepower, and the normal power of the engines is the lower figure given above. TRONTOLITE is a sister vessel of the JOSIAH MACY and of the S. V. HARKNESS, which also have been recently converted.

Largest Scandinavian Tanker

With the launching of the motor tanker IDA KNUDSEN, the Nakskov Shipyard in Denmark lays claim to the construction of the biggest vessel ever built in Scandinavia. She is built on the Isherwood system and can carry about 13,000 tons on a draft of about 28 ft. Between perpendiculars she measures 465 ft. and has a molded breadth of 61 ft. 10 in. and a depth to the main deck of 37 ft. 3 in. The biggest ships built by Burmeister & Wain have been the AFRIKA and the MALAYA which were about 20 ft. shorter b. p. than the IDA KNUDSEN. The propelling machinery will consist of two Burmeister & Wain engines totaling about 2850 s. hp., which will drive the ship at a speed of about 11 knots.

Large 2-cycle Engine

Another large Neptune 2-cycle engine has been put into service. The power is not stated, but it is sufficient to drive a vessel of 9000 tons d.w. at a speed of 11 knots on loaded trial and must therefore be about 2000 s.hp. This engine is installed in the NEPTUNIAN, a single screw ship built for the Hopemount Shipping Company by Swan, Hunter & Wigham Richardson. She is of the open shelter deck type. Her principal dimensions are, length b.p. 400 ft., extreme breadth 55 ft. 3 in. and depth molded to second deck 29 ft. 6 in.

World's Motorship Construction

PRACTICALLY 50 per cent of the world's shipbuilding tonnage is composed of motorvessels, according to the latest figures issued by Lloyd's Register covering the three months ending June 30th last. In Great Britain and Ireland motorships represent only 36.5 per cent of the total construction, but the figure for all other maritime countries is 57.3 per cent. The figure for all countries combined is therefore 47.7 per cent, which compares with 42 per cent for the quarter ended March 31st last, and with 28 per cent at the end of March 1924. The tonnage of vessels building during the first two quarters of this year compare as follows:

	June 30, 1925	March 31, 1925.
Motor ships ...	1,129,912	1,021,631
Other types ...	1,239,919	1,375,279
Total	2,369,831	2,396,910

These figures show a decrease in the total world's shipbuilding, and in fact they form a new low record since the end of the war. It will be observed however that the total tonnage of motorvessels under construction has registered an increase, the falling off having taken place entirely in steam and sailing craft.

A new feature of Lloyd's returns gives additional evidence of the continually spreading acceptance of the motorship. This new feature is the inclusion of figures relating to the total horsepower of the machinery under construction for the vessels covered by the report. The data show that the indicated horsepower now under construction is divided into the following groups:

Diesel engines	808,264 i.hp.
Steam turbines	353,144 i.hp.
Steam reciprocating engines	559,970 i.hp.

Lloyd's specify i.hp. for the turbines as well as for the other classes of machinery, arriving presumably at the figure by computation from the s.hp.

There is little change recorded in the ranking of the various shipbuilding nations during the period under review. Great Britain and Germany are again respectively first and second, but Italy has moved up into third place and is followed by France, Holland and the United States, which has moved up from seventh position to sixth position. Denmark and Japan are respectively seventh and eighth.

It is worthy of note that the volume of motorships on order now is 319,000 tons greater than at June 30, 1924.

Swedish Government Loans

A loan amounting to 50 per cent of the contract price of a motorship of 5000 tons now building at the Eriksberg Shipyard has been requested by the Transatlantic Rederi A/B from the Swedish government. This vessel is intended for freight service between Sweden and North American ports. In its application for the loan the Swedish company stated that as a consequence of increasing competition it has been required to give direct sailings between Stockholm and North America, as well as between Gothenburg and North America, so that Stockholm firms can get as good service as the Gothenburg firms.

Spanish Line Subsidy

In our last issue mention was made of the annual subsidy of $5,460,000 (par value) which the Spanish government has agreed to pay to the Compania Trasatlantica of Barcelona, Spain. It now appears that the Spanish Company has undertaken to build two vessels for the Argentine service before 1828, three for the Mexico service before 1929 and three additional for the same service prior to 1932, two for the Fernando Po Line before 1934 and 14 other various vessels before 1936. The government guarantees the interest and amortization of the invested capital and loans, in case the subsidy is not sufficient.

—Financial Notes—

Svenska Aktiebolaget Nobel Diesel

The Svenska Aktiebolaget Nobel Diesel of Nynäshamn, Sweden, is in liquidation. The business was established by the Nobel interests after their properties in Russia had been confiscated by the Soviet Government, and the staff was composed largely of employees of the former Ludwig Nobel Works in Leningrad, which was one of the first Diesel engine licensees and was the pioneer in the application of Diesel engines to ship propulsion. Very successful engines have been turned out from the Nynäshamn plant, but the company has not had many orders. The creditors have been asked to consent to a six months' stay on their claims to assist in a better realization of the assets.

Transatlantic Steamship Company

For the year 1924 the Transatlantic S.S. Co. of Gothenburg, which has a fleet of 8 motorships and 22 steamers, showed gross profits of about $1,100,000 and net profits amounting to about $143,000. A dividend of 7 per cent was paid on the preferred stock and a small balance carried forward.

Cie. Universelle du Canal Maritime de Suez

During the year 1924 the tonnage passing through the Suez Canal exceeded by 10 per cent the tonnage recorded in 1923. This represents an increase of traffic equal to 25 per cent more than in the last year prior to the European war. The total receipts for the financial year 1924 amounted to the sum of $24,005,182, an increase of $4,216,565. A large part of the increase was due to profits on the transfers of funds, the increase due to traffic being only $1,200,318. The directors have distributed for this year $16,735,570 in dividends, equal with interest to $15.43 per share. The traffic consisted of 5,122 passages representing a net tonnage of 25,109,882. The traffic in ballast represented 9.2 per cent of the total traffic. (Rate of conversion, 4.72 cents per france.)

Nippon Yusen Kaisha

At the semi-annual general meeting of the Nippon Yusen Kaisha held in Tokio about the beginning of June a dividend of 10 per cent was declared. For the purpose of paying this dividend the company had to draw on its reserves, the net profit having been only about $764,000, which is just about the same as in the previous half year. The first motorships of the company are now operating. (Rate of conversion, 41 cents per yen.)

Atlas Diesel A/B

An increase in capital of 3,000,000 kr. has been decided on by the Atlas Diesel A/B of Stockholm, Sweden. The increase will be made through the issue of 60,000 new shares. The outstanding capital amounts to 10,000,000 kr.

Repairing Profitable in Holland

During the year 1924 the Dutch shipbuilding and repair companies operated profitably. The Rotterdam Drydock Co. and the Fijenoord S. B. Co. both paid 10 per cent dividends, and the Royal De Schelde paid 8 per cent.

Subsidy for Japan Liners

For service between San Francisco and Japan the Japanese government has under consideration the construction of four Diesel driven liners of 17,000 tons each. It is reported that an appropriation for these vessels has been included in the Japanese budget for the fiscal year 1925-26 and that a government subsidy will be given for their operation.

Bunker Tanker Ordered

A Diesel electric tank barge of 6000 bbl. capacity has been ordered by the General Petroleum Company of Los Angeles for bunker service on San Francisco Bay. The vessel will be 172 ft. long with a breadth of 32 ft. and will be driven by two Atlas Imperial engines of 250 hp. each, giving her a speed of 9 knots. The order has been entrusted to the Bethlehem Shipbuilding Co. with 4½ months delivery.

Korsholm Makes Record

A new record for cargo ships between New York and Stockholm was set up by the motorship KORSHOLM on her first return passage from the United States. She is a new vessel of the Swedish-American Line and a picture of her was given in the July issue of MOTORSHIP. She arrived in New York after her maiden passage early in June and sailed again on June 23rd, arriving in Stockholm on July 8th. The voyage was thus made in 14 days and 22 hours. The direct cargo service of the Swedish-American Line between New York and Stockholm will be maintained by the motorships KORSHOLM and KOLSNAREN, together with one steamer.

This new motortanker of 3600 hp. has been chartered by the General Petroleum Co. for a long period

New Norwegian Tanker

NORDANGER, a motor tankship of 13,000 tons d.w.c. ran her trials off the coast of Holland recently and was delivered to her owners, Westphal, Larsen & Co. of Bergen, Norway. She has been built on the Millar system of framing and is 470 ft. in length overall with a breadth of 60 ft. and a depth of 38 ft. 6 in. She is driven by two Werkspoor Diesel engines of 1800 hp. each, which give her a speed of about 11 knots. It is reported from Holland that she has been chartered for a term of years by the General Petroleum Corp. of Los Angeles, which already has in service the VARANGER, a sister vessel completed earlier in the year.

A new direct service for passengers and freight between San Francisco and Great Britain and Sweden will be started in October by the Johnson Line of Sweden. The service will be maintained by two new motorships, AXEL JOHNSON and ANNIE JOHNSON.

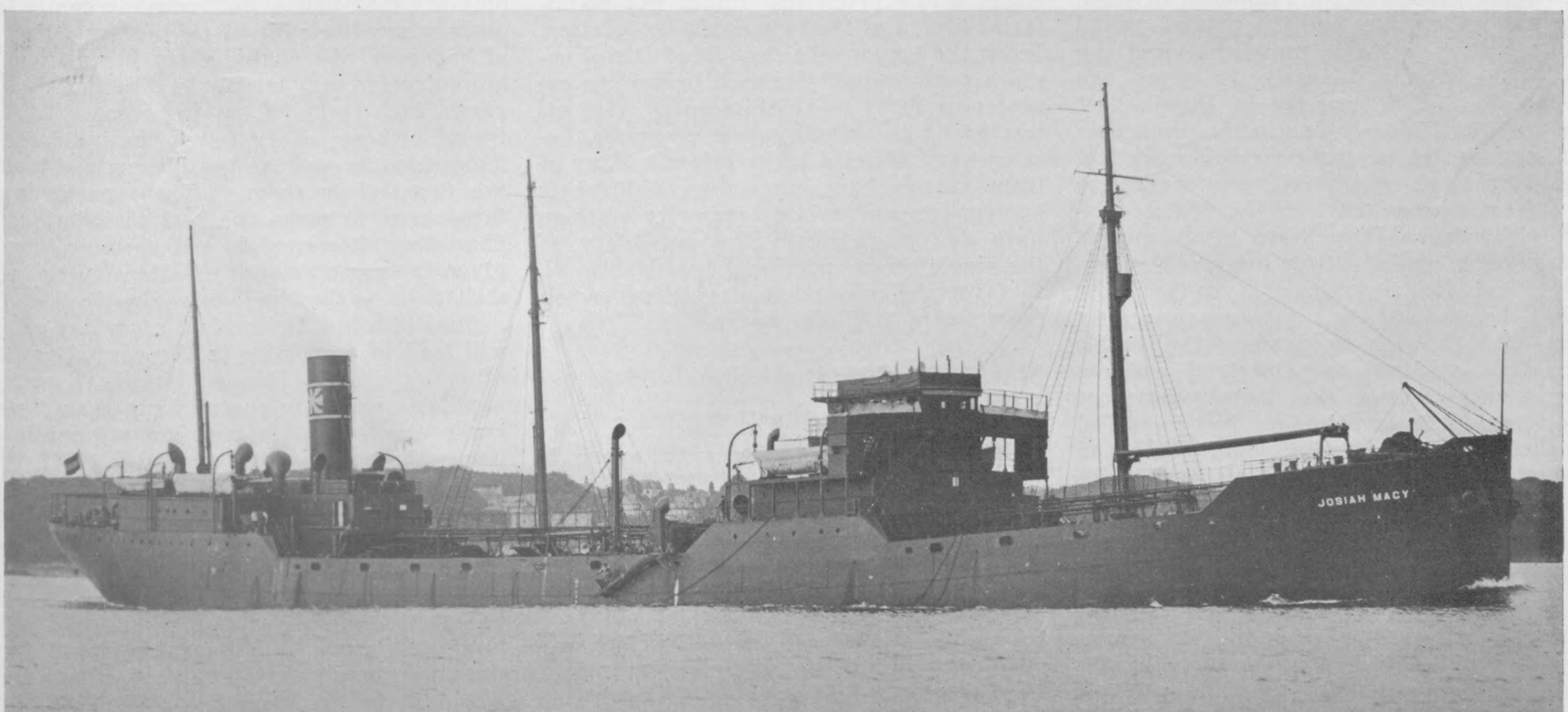
Twin screw Sulzer type engines of 8000 s. hp. are to be installed in the new combination freight and passenger vessel of 10,000 tons gross which the Bibby Line has ordered from the Fairfield Shipbuilding & Engineering Company. The boat will have a maintained sea speed of 15 knots and will carry about 300 first class passengers.

Converted Danzig Tanker

JOSIAH MACY, a sister ship of the TRONTOLITE, but belonging to other owners, the Baltisch - Americanische Petroleum Ges., started on her maiden passage in the last days of June. She was built as a single screw turbine-driven tanker by the Skinner & Eddy Corp. of Seattle in 1917. Her registered dimensions are 419.5 ft. x 57.2 ft. x 29.8 ft. with a gross tonnage of 6899 and a d.w. of 9590 tons. At the Krupp yards her steam machinery has been replaced by a 6-cylinder engine giving 2150 s.hp. at 90 r.p.m. and of the standard Krupp 2-cycle type.

Götaverken's 25 Motorships

With the delivery of the AGRA to the Swedish East Asiatic Company the Götaverken have completed their 25th ocean going motorship. The AGRA is for the Indian service of the Swedish East Asiatic Co. and is a shelter deck vessel of about 7700 tons d.w.c. She measures 390 ft. b.p., 52 ft. 6 in. molded breadth and 28 ft. molded depth to the main deck. Her main engines consist of a twin screw installation of 6-cylinder Götaverken engines of about 1350 s.hp. each at 120 r.p.m. For supplying power to the auxiliaries there are three generators of 66 kw. each, directly coupled to a 100 b.hp. 2-cylinder engine. There are ten 3-ton cargo winches all electrically driven, a hydraulic electric steering engine and an electric windlass. The Swedish East Asiatic Co. is one of the Broström lines and operates the motorvessels FORMOSA, CANTON and NANKING. Another motorship is building for the same company's service.



Motortanker Josiah Macy, a sister ship of the Trontolite and S. V. Harkness and like them recently converted from steam

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Readers are invited by the Editor to submit articles, photographs or drawings relating to motorships, marine oil-engines or auxiliaries. Contributions used in the magazine are paid for on the 15th of the title month of issue, and other contributions are returned as promptly as possible.

Lineshaft Breakages Can Be Avoided by Study

DURING the last couple of years there have been a number of instances of shaft fracture in oil engine installations, and more particularly on dredges. The tendency has been to lay the blame on the oil engines themselves, whereas really the trouble has been due to lack of forethought and of proper study of the installation. No new problem has arisen. Ever since high compression oil engines have been built there have been instances of shaft fractures arising from resonance between the engine impulses and the natural period of vibration of the masses hooked up with the engine. Nearly 20 years ago when the Nobel company in Russia first applied the Diesel engine to the propulsion of vessels in a serious and practical manner, these shaft fractures began to manifest themselves. In the Nobel side-wheel towboats there were heavy masses of gearing and shafting for speed reduction and for reversing. Even in those days the cause of the trouble was correctly diagnosed, but the avoidance of the trouble could be achieved only by trial and experiment. Before the Nobel engineers got rid of the trouble they had increased the size of their lineshafts until they had a section eight times greater than Lloyd's require for steam engines of the same power. That was in the days before Lloyds brought out their rules for internal combustion engines.

Similar troubles were encountered in steam turbine construction and for a number of years formed a serious difficulty for the turbine builders. Analysis of the problem finally resulted in a fairly simple mathematical method of determining in advance the speeds at which resonance will occur. The turbine builders got rid of their troubles, and gradually the oil engine builders have learned to get rid of theirs. The Navy Department suffered very badly from such troubles in submarines, and these have been finally eliminated. The men today who suffer are those who buy their engines and hook them up with all sorts of lineshafts, couplings, gears and rotating masses of one sort or another without any regard whatever to the problems they are introducing. With the extensive experience and knowledge of these problems today it is wise for everybody to seek competent help in this direction before laying out any installations.

Single Screw Motorships Becoming Numerous

ALTHOUGH in the first few years of motorship history there were several examples of single screw construction, the hazards affecting motorship operation in those days were sufficiently pronounced to render the single screw motorvessel undesirable. After the first few failures of the single screw motorships there followed a period of years when practically every motorvessel that was built was of the twin screw type. Improvements in the marine oil engine rendering this type of machinery as dependable as steam and the increased experience of motor engineers who acquired a skill that matched the skill of the steam engineers have removed the objections against the single screw installations. Since 1920 an increasing favor has been shown towards this type again.

It is still surprising to many people in the shipping world today to learn that a motorvessel need not necessarily be of the twin screw type. A distinct departure in Diesel engine design was introduced five or six years ago in order to make the machinery more suitable for the single screw drive. This was the introduction of the so-called long stroke engine, which has since been adopted by many of the leading engine builders. The slower revolutions were required in order that the efficiency of the single screw propulsion might not be inferior to that of the twin screw installation. When the long stroke slow-speed Diesel engines were brought forward by marine engineering firms many shipowners were attracted by the single screw proposals, because they afforded lower prices. Many of these vessels have more than 2000 shaft horsepower, and a large majority of them have 2-cycle engines. The possibility of the single screw motorship has done much to favor the conversion of existing vessels from steam to Diesel power.

Motorship Building Equals Steamer Construction

DURING the last two years the quarterly Lloyd's returns of shipbuilding throughout the world have shown such a steadily progressive increase in motorship building that every vestige of doubt anyone may have retained about the ultimate supremacy of the motorvessel should have been removed. We do not contemplate that steamers will entirely disappear, any more than we expect sailing ships to vanish forever. Sailing vessels have survived and steamers will survive. The motorship, however, will be the most approved and most widely accepted type. That a large body of shipowners today share much the same views is supported by the evidence of Lloyd's shipbuilding returns.

At the end of June of this year 47.7 per cent of the total shipbuilding throughout the world was accounted for by motorvessels under construction. This is substantially one-half of all the work in hand, and surely nobody will quibble if the statement is made that motorship building today equals steamer construction. The fact that we hail the attainment of this goal must not be construed as an expression of belief that the motorship has yet reached the limit of its growth. On the contrary, this marks only the half-way stage. The motorship must progress until the steamer is relegated to the omnibus classification of "all other vessels." Many years will elapse probably before that final goal is attained. How many years it will take, one cannot foretell. For seventy years steam struggled against sails for supremacy. If we set down the year 1812 as the birth year of the steamboat we can also mark the year 1880 as the year when steamer construction first outstripped the building of sailing ships in the United States. The motorship has grown much more rapidly. We regard the year 1912 as the real birth year of the motorship, although Diesel engines had been installed in boats about 10 years earlier. Between 1912 and 1925 the motorship achieved practically as rapid a growth as the steamer made in 70 years. We shall have to wait until next year for motorship construction to exceed steamship building although possibly the mark will be reached before the end of this year.

Simplification of Marine Oil Engine Installations

FOR all the progress that has been made in the last 10 years in the design of marine oil engines, there has been little or nothing done to simplify the engine room installations of motorships. This is largely attributable no doubt to the fact that whereas the design of any engine is the job of only one man and a staff working continuously year after year along the same lines of endeavor, the engine room installations are entrusted very largely to different shipyards, each carrying out the ideas of different owners. Very few firms build the motorships as well as the oil engines that are installed in them. These particular firms seem to make the best installations. Even they, however, do not seem to have given the same amount of attention to installations as they have to engine design.

Simplification in engine room lay-outs will lead to economies in the capital costs of motorvessels. Many ships have more auxiliaries in their engine room than they really need. This is true right down the line to the smallest oil engined boats. There are of course, different schools of thought. Some shipowners incline towards the complete duplication of every piece of machinery in the vessel with the exception only of the emergency compressor set. Other owners with an eye to the reduction of their investment have had the engine room installations studied with care and have effected a certain amount of simplification. It does seem, however, as if more progress could be made in this direction.

Sketches and Working of Oil Engines*

Arrangements and Types of Cylinder Heads Considered from the Viewpoint of the Relation Between Design and Operation.

LIKE the cylinder of an oil engine the cylinder head is called upon to perform double duty in resisting both stress and heat. Neither the mechanical influence nor the thermal influence to which a cylinder head is subjected would of itself be a serious matter; there are many machine parts separately exposed to both and functioning without any particular engineering problem.

As far as heat action is concerned, the cylinder head of an oil engine is subjected to about the same conditions as the upper end of the cylinder liner considered in the previous chapter. The fire on one side of the metal wall and the cold water on the other side set up temperature stresses which are intensified by uneven sections, corners and lumps, a condition somewhat aggravated by the fact that the cylinder head generally contains valve pockets and other intricacies.

Mechanically the structure of a cylinder head is generally less favorable than that of the liner, because it resembles a flat plate more than it does a cylinder. Exposed on its underside to the uniformly distributed load of the gas pressure it gets its support from the holding-down bolts near the periphery. In its elements the cylinder head is a flat disc reacting to the sum-total of the pressure load and transmitting this load through its outer circumference to the engine framework. Even if a simple flat circular disc could be used for such service the stresses arising in it would be far from simple.

Most oil engine cylinder heads, as a matter of fact, consist of two discs *a* and *b* (Fig. 66) connected by a cylindrical shell *c* and various essentially tubular valve pockets *d*. Whereas the lower of the two discs is the one directly exposed to the fire and to the pressure, it is the upper one to which the holding forces of the bolts are applied, and its function is not merely that of confining the cooling water. The upper disc collects the forces originating in the lower disc and transmitted upward through the outer shell and through the valve-pocket tubes; were it not for the supporting effect of the latter the lower disc would have to be made considerably thicker in order to be capable of withstanding the mechanical stress. From that point of view the cylinder head may be compared to an inverted bridge truss having one set of members for taking up the load directly and another set for distributing the load throughout the structure.

A digression for the purpose of showing why bridge trusses are arched and made deep would be out of place here beyond pointing out that this practice makes it possible to secure strength with a minimum of material. Economy of material is important from the cylinder-head point of view not for business considerations alone, but for two other equally cogent reasons.

If the lower disc can be made strong by virtue of the support it gets from the upper disc, it may be cast correspondingly thinner, a consideration which the study of cylinder liners has already shown to be of prime importance. Separating the head into two discs has the further advantage of permitting the upper disc to be made almost indefinitely thick for reasons of strength while the lower disc may be made thin enough to avoid undue temperature stresses. Some designers, in fact, have gone so far as to use an actually separate plate for the lower disc, arranged only for heat resistance and incapable of taking anything but a nominal share of the mechanical load itself. It is easy to assume, of course, that the shell and upper disc serve merely as a water jacket, but in relation to the considerations just mentioned the water jacket is of secondary importance. It is conceivable that water space could be provided by means of a sheet metal covering not sharing in the transmission of stress.

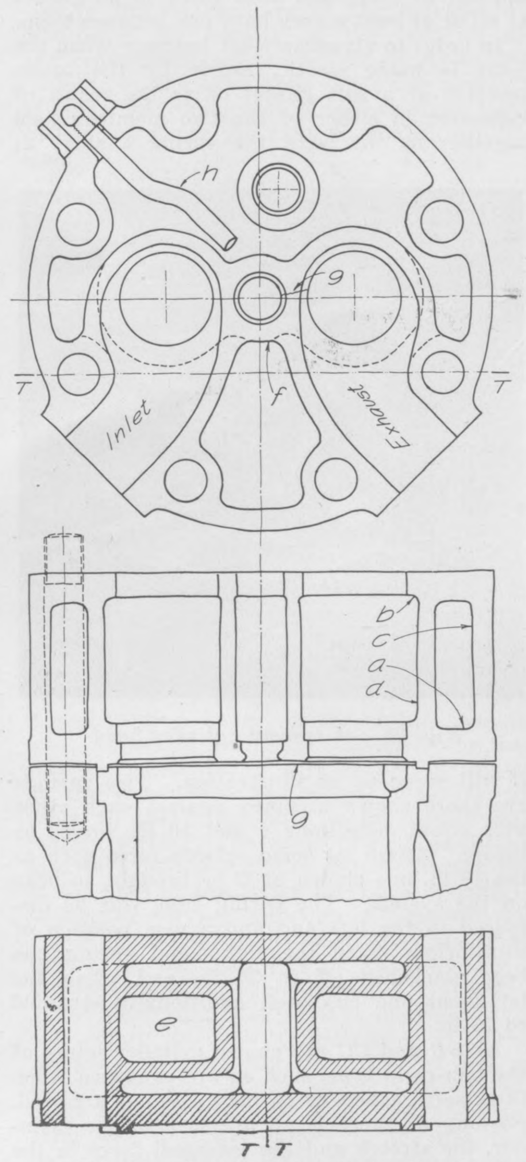


Fig. 66. Sections of cylinder head

In four-cycle engines the cylinder head is also the member through which fresh air is introduced and exhaust gases expelled; in nearly all cases it also contains the fuel and starting valves. Two-cycle engines in which the scavenging air is admitted through poppet valves have heads structurally identical—or nearly so—with four-cycle heads.

As will be seen in the later study of valve gears, practically the only valve which comes into consideration for air admission and exhaust is of the poppet or mushroom type ground to a conical seat and registering with a correspondingly ground circular opening. Owing to the fact that nearly the entire length of the cylinder bore is swept over by the piston, the head is the only place where the valves may be accommodated. In vertical engines the valve spindles are generally parallel to the cylinder axis, although vertical designs are found in which the valves are placed horizontally or at right angles to the bore of the cylinder.

In most large engines and in some small ones the poppet valves are contained in separate cages or bushes, but examples are found also where the poppet valve is seated directly on the metal of the head. The latter arrangement has the advantage of simplicity and permits the ground seat of the valve to be effectively water-cooled; but it necessitates removing the entire head whenever a valve is to be withdrawn for cleaning, grinding or replacement.

Whether or not valve cages are used on vertical engines, the valve passages consist of tubes or cylinders intersecting the lower cylinder head disc. A vertical engine cylinder head with vertically-placed valves generally has two large tubes of this kind which in turn connect with horizontal rectangular-sectioned passages (*e*, Fig. 66) leading out through the circumferential shell of the head.

Naturally the rectangular passages leading up to the valve tubes are kept clear of the lower and upper discs to permit adequate water circulation above and below them. As far as the lower disc is concerned, there is need for cooling as great a portion of its surface as possible, and to place either the inlet or the exhaust passage directly adjacent to it would therefore be impracticable. Since the passage for exhaust gases must also be completely water-cooled, it too is kept out of contact with the two discs. For the sake of symmetry the inlet passage is similarly moulded, although there might conceivably be no objection to allowing its upper wall to coincide with the upper disc.

Reference to the illustrations will readily afford a clear grasp of these conditions and will enable the student to make a mental picture of them. Upon looking at the outside of an actual cylinder head of a vertical four-cycle engine the approximate location of the gas passages is given by the elbows or machined flanges to which the inlet breathers and exhaust elbows are connected. From the design point of view the governing consideration is that the ducts shall pass out between the large studs located in the periphery of the head. For the best type of fastening between the cylinder head and cylinder a large number of relatively small studs would be desirable, because they would give the best stress distribution over the cylinder head casting and by reducing its diameter would correspondingly diminish the bending stress. However, the consideration that the gas passages shall pass between them and that they shall be equally spaced compels the adoption of a relatively small number of large studs. The gas passages are required to have a certain definite cross-sectional area; if the space between the studs is limited the cylinder head must be designed high. Six or eight studs are most commonly found, although a small engine with seven cylinder head studs has recently made its apearance.

Because of the relatively small number of heavy studs used for the cylinder head fastening care must be exercised in tightening them up—how the joint goes together has already been discussed for a typical example in chapter 5. (MOTORSHIP for May, 1925, p. 382, Fig. 58.) Care must be exercised above all things to see that the tension in all the studs is brought up evenly, and for that purpose the well-known method of tightening up

* Summary of a course of instruction at the Polytechnic Institute, Brooklyn, N. Y., by Julius Kuttner, B.Sc., Licensed Chief Engineer, Editor of OIL ENGINE POWER. This is the seventh chapter, the first one having appeared in the January 1925 issue.

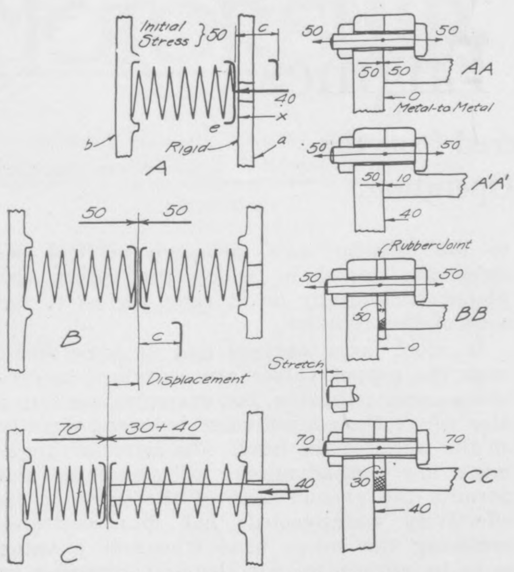


Fig. 67. Diagram of bolt stresses

"across corners" is to be recommended. Every mechanic knows that if the packing is unduly squeezed by excessive hauling down on one side, no amount of force exerted on the opposite side will close up the joint there. In fact, it is a good plan to check up the gap *e* at four places around the circumference while the nuts are being tightened.

Many an operator has no doubt wondered how tight the nuts are to be set up and whether the initial stress set up by the wrench is supplementary to that which is caused by the pressure of the gas. As long as the nut can still stand a little more tightening the sledge used on the end of the wrench will have a "dead" feeling as each blow is struck. As soon as it begins to show signs of rebounding the point has been reached beyond which further tightening would probably be unsafe.

Whether or not the initial load due to setting up the nut is added to the working load is a question not readily to be answered out of hand. Good authorities are found both on the negative and on the affirmative side of it. To say that the two loads simply add up appears as simple as "putting two and two together," but there is more to it than just that.

Consider first the diagram shown at *A* (Fig. 67) in which an ordinary coiled spring is represented as compressed between rigid abutments *a* and *b* with an initial stress of 50 lb. and an initial deflection equal to *c*. In thinking about problems of this kind it is useful to bear in mind constantly the fact that no force can be taken up or exerted by any material without a certain amount of yielding or deflection. In order to emphasize this point, springs have been used in the diagrams to represent bodies subject to perceptible deflection, and rigid bodies have been depicted in spite of the fact that 190 per cent rigidity is really something unthinkable. When a bolt is tightened up it stretches, while the cylinder head which it is squeezing compresses slightly.

In diagram *A* it is assumed that all the deflection is in the spring while the abutment *a* has remained absolutely steadfast; the problem then arises as to what will happen to the spring when the supplementary force of 40 lb. is applied. Since 40 lb. are less than 50 lb. the spring cap *e* cannot be moved, otherwise a gap would open at *x*, the cap *e* would lose all its support from *a* and we would end up with the 40 lb. force balancing the 50 lb. force and a little more besides. It is impossible, therefore, that the 50 lb. initial deflection of the spring should have been in any way increased by the addition of the extra 40 lb.

What has actually taken place is that the force exerted at *x* by the support *a* has been changed. Without the 40 lb. force *a* was taking up the full 50 lb. reaction from the spring; after the 40 lb. force was applied only 10 lb. remained at *x*. As far as the spring is concerned it makes no difference whether the entire 50 lb. are coming from *a* or whether *a* supplies 10 while the supplementary force furnishes 40.

At *AA* (Fig. 67) is sketched a cylinder head to which the foregoing reasoning would also apply. With an initial bolt load of 50 lb. the reaction between the metal surfaces of the cylinder and of the cylinder cover is also equal to that amount, so long as there is no gas pressure within the cylinder. Suppose now that a load of 40 lb. is imposed on the cylinder cover from within (diagram AA) and assume that the position of the parts remains unchanged: the tension in the bolt remains unaltered at 50 lb. and the reaction between the surface is reduced from 50 to 10 lb.

The conclusion is based on the assumption that neither the cylinder cover nor the cylinder yield in any way when the forces are applied to them and that there is no gasket at all or at least a very hard one between them.

In order to visualize what happens when the joint is made elastic, either by the interposition of a soft gasket or as the result of deflection in either of the two members held together by the bolts, the spring analogy at

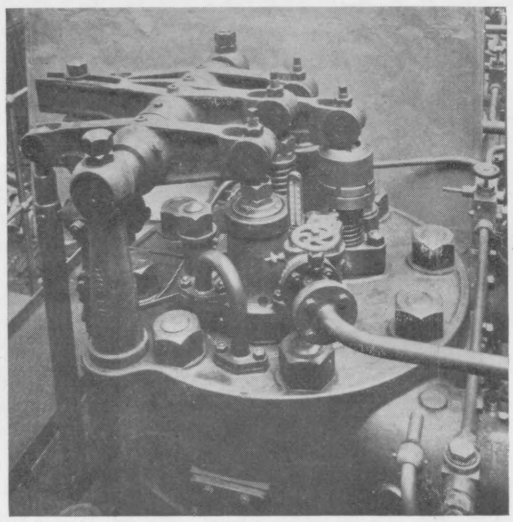


Fig. 68. A typical cylinder head

B will serve as an illustration. Two springs are there shown strained against each other with equal deflections *c* and 50 lb. forces as before. Again let some outside force such as the 40 lb. one shown at *C* be brought to bear on the system. The spring caps will be displaced to the left and find a new position of equilibrium when the right-hand spring has been slackened off to 30 lb. and when the left-hand one has been additionally strained to 70 lb.

At *BB* and *CC* are shown cylinder joints of the non-rigid type, such as are produced when thick soft gaskets or springy castings are used. So long as there is no pressure in the cylinder, the stretch and the tensional force in the bolts are equal to the yielding and compressive force of the gasket. Now let a force of 40 lb (*CC*) be applied within. Assisted by a 30 lb. elastic force coming from the gasket, the 40 lb. load brings the bolt tension up to 70 lb. while the bolt is stretched by the amount indicated on the figure.

By a comparison of the two cases *AA* and *BB* it is apparent that when the joint is a hard one the extra load due to the gas pressure fails to make the cover shift, so long as the load is equal to or less than the bolt tension. As long as the bolts are not additionally stretched they are not additionally loaded.

There is hence no cause for fear that a good reasonable setting-up tension in the cylinder head bolts will encourage breakage provided that a ground joint or a metallic copper gasket is used. On the other hand, there is no assurance against a serious increase of bolt strain if a thick soft gasket is used. The more accurate the joint surfaces the less of a gasket is required for it and the easier it is on the bolts.

In contrast with the combustion space of gas engines, those of oil engines are limited in size because of the higher compression and therefore smaller clearance is employed. At the same time the supply of air to, and the exhausting of gases from, the cylinder of an oil engine occur at about the same velocities as are found in other internal combustion engines, with the net result that less room is available in an oil engine for the location of the valves and passages.

How this affects design and manufacture is not our primary interest here, and this phase of the matter is to be touched upon only in so far as an understanding of it may be of service to the operator and user. Once the cylinder bore and piston speed of an engine are given, they determine the size of valve and areas of the passages which must be used. Keeping down air and gas velocities to a figure around 100 ft. per second is not always easy, but is an object which must be striven after if the rating of the engine is not to be impaired. The maximum steady power output which can be safely realized from an engine is in the last analysis determined by the amount of fresh air which can be made to pass through it, because that fixes the amount of fuel which can be burnt cleanly and without harmful temperature rise.

No matter whether the valve centerlines are parallel to or athwart the cylinder axis, it is difficult to accommodate valves of adequate size without doing a certain amount of violence to the shape of the cylinder head casting. That is why a high degree of compactness is observable in most cylinder head designs and explains why wall thicknesses, water spaces, and clearances have generally been apportioned and balanced up with considerable care.

When both the exhaust and inlet valves are placed parallel to the cylinder bore it follows that (as far as modern oil engines are concerned) their heads are located next to each other. L-head constructions (Fig. 69) have been largely discarded for oil engine work because of the unfavorable cylinder head castings to which they give rise. The head i

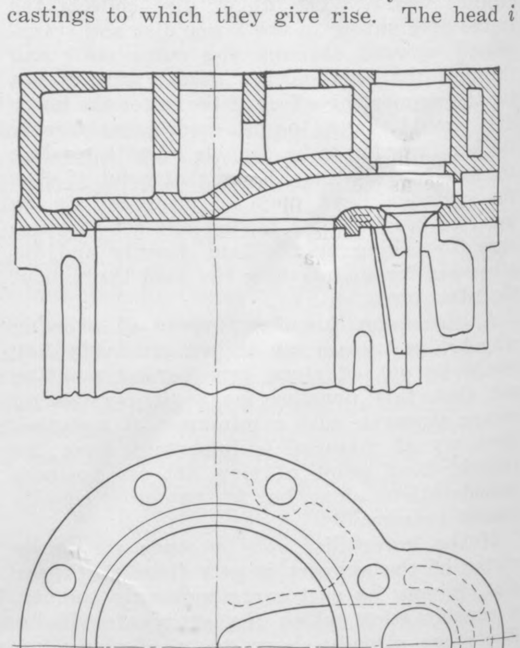


Fig. 69. L-type cylinder head

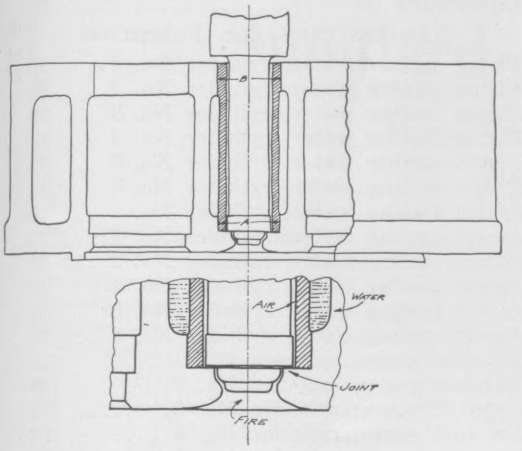


Fig. 70. Steel tube for fuel valve

sketched in Fig. 69, incidentally, is a particularly good illustration of the difference between gas and oil engine practice. Its satisfactory performance in early gas engine work led the first American oil engine designers to adopt it with little alteration. When the L-head construction is carried out with the cylinder and head cast integral it is far less objectionable than in the present case where the head is cast separate and makes a joint with the cylinder just at the corner of the L. A precarious uncooled bridge of metal is all that is left standing between the exhaust valve hole and the opening for the combustion space. This bridge can be neither cored, cooled, nor kept from cracking. Although it was only a small chunk of metal, it was one of the heaviest burdens the early American Diesel engine industry had to bear.

As a rule, it may be said that when the valve spindles are parallel to the bore the valves and passages are next to each other; in a great many cases the valves are located on a diameter of the cylinder head with the fuel valve between them.

Operators and users who have been faithful about cleaning scale from the cored water jackets of cylinder heads and who have wondered why everything is located so close together may also have observed that the row of three valves—exhaust, fuel, inlet—is so long that the outer edges of the exhaust and inlet valves are separated by a distance which is frequently greater than the cylinder bore. Were it not for the fact that clearance pockets are milled in the cylinder liner at the places where the valve heads dip down it would not be possible to open them. It shows that the designer has first squeezed the valves together as close as he could and has then still found it necessary to mill the pockets in the liner in order to avoid sacrificing valve diameter. Strange as it may seem, the weakening of the liner caused by the milling does not encourage it to crack at that place while in service. The cracking of liners, in fact, is a rare occurrence and rupturing at the milled pockets is so unusual that for practical purposes it may be said not to occur.

In the cylinder heads of smaller engines the valve pockets for the inlet, fuel, and exhaust valves are generally cast so close together that they touch (*f*, Fig. 66), no attempt being made to get a core between them. Should it be possible to make a core that would stand up at this location, the sand from the core would probably be found baked in quite hard after pouring, and in the subsequent operation of the engine accumulations of scale at that point would have to be guarded against. In larger engines where the harmful effects of casting the valve pockets together would be really serious, there is also more room to get a core in and besides that special expedients such as placing the fuel valve pocket slightly off center are sometimes resorted to.

Space limitations which tax the patternmaker's ingenuity in making cores require the operator's vigilance in avoiding scale. How and why scale is deposited is too much of a steam-engineering commonplace to require extended treatment here. However, a good many operators think that because the cooling water of an oil engine is not, or should not be, actively vaporized scale formation is not to be worried about.

This idea is correct in so far as salt water used at sea does not deposit much scale so long as its temperature is kept below about 110° F. Attention has been drawn, however, to the fact that sluggish water circulation around certain heated parts of the combustion space may result in locally heating the water far beyond this point and in forming scale just at a point where it is least wanted.

As in the case of a steam boiler the presence of scale interferes with the transmission of heat and allows the temperature of the metal to rise. The efficiency of the oil engine is thereby impaired because the consequent rise in the temperature of the indrawn air diminishes the density of the indrawn air and consequently of the weight of its oxygen content; at the same time the waste products of impaired combustion interfere with lubrication and lower the running qualities of the machine.

By far the most serious effect of scale on the oil engine is the rise in temperature of the cast-iron walls surrounding the combustion space; all the heat-stress conditions discussed in the preceding chapter are thereby accentuated and liability to destruction by cracking greatly increased. In this respect cylinder heads are more delicate even than the liners because of the necessarily irregular casting shapes found in the former. Smooth cylindrical or spherical casting shapes are geometrically best suited for the transmission of stress; they can therefore be made thinnest and can get rid of their heat most readily. At the same time the flow of cooling water around them can be made reliable and positive.

In a cylinder head containing valve pockets it is impossible for the designer to avoid intersections, corners, pockets and bosses, any one of which is less favorable for heat and stress transmission than the plain smooth wall. A hollow sphere with a source of heat inside of it and cooling water on the outside has the most favorable ratio of heat-absorbing surface to heat-emitting surface and if subject at the same time to internal pressure will react to the latter with a practically pure tension stress. The same applies essentially also to a hollow cylindrical body except that in the case of the latter the ratio of exterior to interior surface, although still greater than 1:1 is not so favorable as in the case of the sphere. A flat plate has the same amount of heat-absorbing as heat-emitting surface while at the same time it is perhaps the least favorable shape for the transmission of stress. Angles or corners concave to the fire side are fairly favorable as far as ratio of the surfaces is concerned. On the other hand anything like a corner convex to the fire (projecting into it) is at double disadvantage, because of the bad surface ratio and because of the fact that the cross sectional area through which the heat from the tip of the projection may be conducted elsewhere is disproportionately small. Hollow conical forms have great inherent stiffness and strength, and are found successfully applied in a great many designs.

Mention has already been made of the support which the lower cylinder head disc receives from the valve pocket tubes intersecting it; the tubes act as columns transmitting load from the disc and helping prevent the latter from bulging upwards. In a way this support is bought at the expense of a certain degree of integrity of the lower disc, because relatively sharp corners are left at the places where the valve holes break through. One way of minimizing the occurrence of cracks at the edges of the holes is to round them off with a large radius or to give them a broad bevel.

Two or more holes adjacent to one another are inclined to produce cracks in the bridge (*g*, Fig. 67) left standing between them, a tendency which is heightened by the fact that it is quite difficult to get any cooling water close to the bridge itself. A line joining the centers of the holes situated next to each other intersects the bridge at the point where it is narrowest; this is also the point where the valve tubes above the holes become tangent and where the metal in them runs together.

As far as running the metal together is concerned, this condition is limited practically to four-cycle engines of smaller power. Attention has on several previous occasions been drawn to the fact that heat and stress conditions in small engines have practically lost their significance in the light of modern achievements; four-cycle operation, moreover, does not tax the metal severely. The discussion forming the basis of this chapter is to be interpreted as an adverse criticism only if it is found to apply to engines, say, with a bore exceeding 16 inches and to two-cycle cylinder heads.

One way of getting rid of the metal accumulations between the three valve pockets consists in using a thin-walled tube around the fuel valve cage as sketched in Fig. 70. The tube is generally of steel carefully tinned on the outside and turned to a drive fit in the lower as well as the upper disc. It is important to note that the use of the tube does not alter the method of making the joint between the end of the fuel valve cage and the lower disc; as a matter of fact the tube merely keeps the cooling water away from the fuel valve and prevents it from flowing into the cylinder when the fuel valve is withdrawn.

Much of the success achieved with cylinder heads of modern construction is attributable to the provision of good cooling water circulation. It might appear difficult at first sight to secure a good flow of cooling water around a combination of three tangent valve tubes forming a solid barrier to circulation between the upper and lower cylinder head discs. Naturally if the cooling water enters the head casting at some indifferent point and is drawn off again without regard to securing active flow, stagnation is apt to result particularly at the intersection of the fuel valve tube with the lower disc, this being

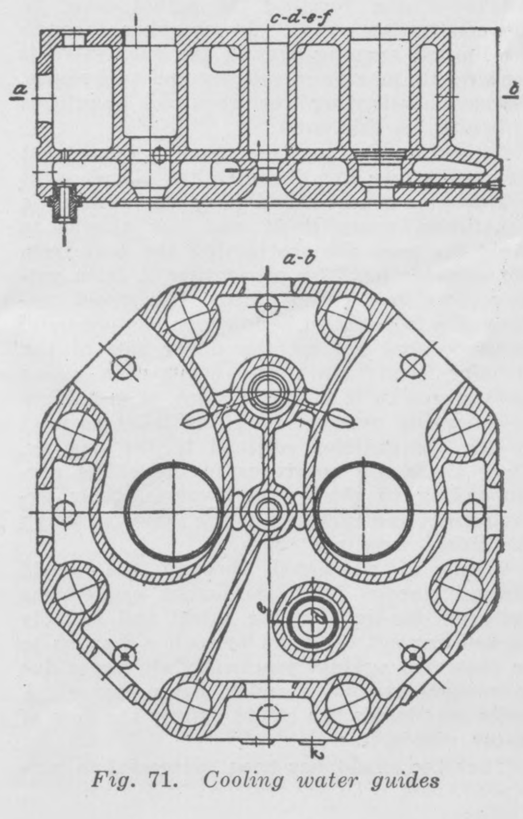


Fig. 71. Cooling water guides

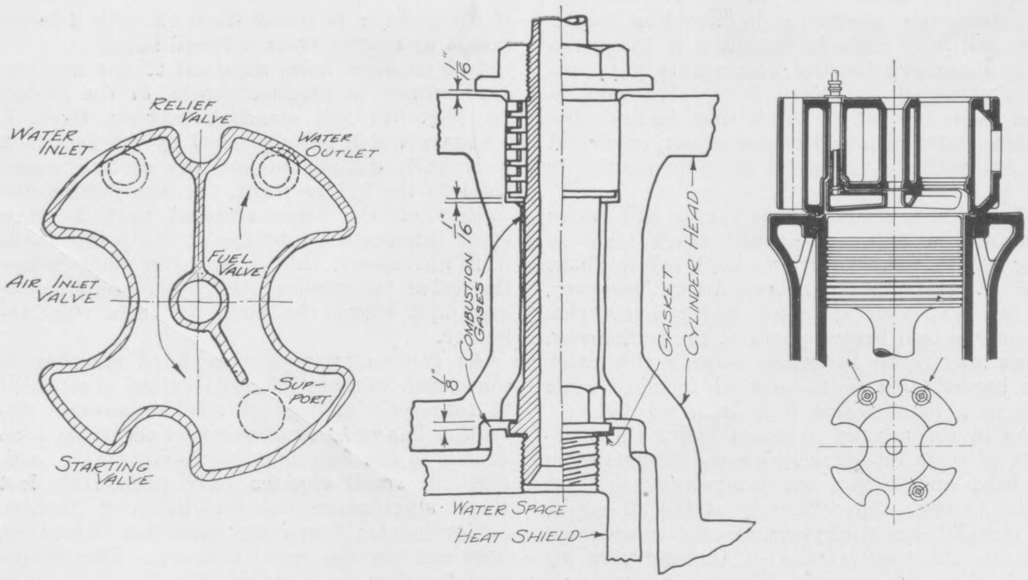


Fig. 72. Heat shield made of hollow casting laid against cylinder head

perhaps the most critical point of the entire casting. It has therefore been found advantageous to introduce the water coming from the lower parts of the engine by means of a short length of pipe or nozzle (*h*, Fig. 66) projecting inwards from a hand-hole cover and directing an active stream against the critical corner. Placing the fuel valve off-center also allows a free movement of water to take place between the exhaust and inlet valve pockets.

Water is sometimes also introduced into the cylinder head by means of a series of rubber-packed nipples forming outlets for the cylinder-jacket cooling water (Fig. 71). This arrangement has the advantage of distributing the cool water uniformly throughout the entire casting, but ordinarily leaves the problem of cooling the fuel valve intersection untouched. Largely for the purpose of correcting this a diaphragm is sometimes cast parallel to the head discs and separated from the lower disc by an amount sufficient for accommodating a sound core. There is only one perforation in this auxiliary diaphragm through which the water can escape upwards and that is situated around the fuel valve tube. All the water entering the six or more nipples above referred to is constrained by the diaphragm to flow at increasing velocity over the lower disc forming the actual cover to the combustion space. In escaping through the limited opening around the fuel valve it acquires its maximum velocity and turbulence, thereby abstracting the required quantities of heat from this point.

Attacking the problem from a somewhat different angle, one designer has placed what is known as a heat shield (Fig. 72) within the combustion space itself and has sought to avoid the need for abstracting the heat from the cylinder head by preventing it from getting there in the first place. The shield consists of a thin-walled hollow iron casting quite loosely placed against the under side of the cylinder head; since the combustion gases have access to it from all sides, it is subject to collapsing pressure only and takes no part in the transmission of load to the casting. Since there are apertures in the shield corresponding to the various valves, their arrangement and operation is the same as though the shield were not there.

Water is circulated through the shield through special inlet and outlet connections fastened gas-tight to the shield and slidably packed against the head in such a way as to be protected against practically all forces due to unequal expansion and to gas pressure. A baffle cast inside the shield defines the flow of water within it.

That the shield has been successful in protecting heads against cracking appears to be borne out by its use in connection with two-cycle engines having dual scavenging valves of the poppet type located in the head. On the other hand, the shield itself has been known to crack—again on a line joining the three valve holes—in spite of the fact that the mechanical stresses in it should be trifling. A normal cylinder head, it will be recalled, is subject to a combination of heat and mechanical stress, and the shield embodies one attempt to control the two by separating them. The cracks which occurred in the shields are attributed by some to insufficient water circulation and to the consequent deposition of much sludge. Needless to say, the cleaning of the inside of the shield must have presented some difficulty.

The shields were also said to have a way of corroding through on the top—a location which would at first sight appear to be best protected. It is suggested by way of explanation that the narrow space between the shield and the head allows the combustion gases which find their way there to become cooled to the point where the water vapor which they contain is condensed out and forms sulphurous acid in combination with sulphur dioxide gas.

Among the most promising solutions of the cylinder head problem are those which depend upon casting all or a part of the cylinder barrel with integral head, a construction quite different from those in which the cylinder water jacket is an integral part of the casting. Integral heads and liners will be considered at the opening of the next chapter.

(To be continued)

Trials of m.s. Jacksonville

During the three-day trial trip of the JACKSONVILLE, recently converted from steam by the New York Shipbuilding Corporation and described in the May issue of MOTORSHIP, the following data were obtained by averages. They form a useful technical record.

Trial Trip Data

Averaged on Three-Day Trial
m.s. JACKSONVILLE

I.hp. average	2255
R.p.m., average	106.8
PRESSURES—lb. per sq. in.	
Starting air	329
Injection air—working bottle	869
Injection air—reserve bottle	910
L. p. stage—air compressor	13
I. p. stage—air compressor	84
Air to whistle	145
Cooling water	18
Lubricating oil	25
TEMPERATURES—deg. Fahrenheit	
Piston cooling water, cylinder No. 1	90
Piston cooling water, cylinder No. 2	96
Piston cooling water, cylinder No. 3	96
Piston cooling water, cylinder No. 4	92
Piston cooling water, cylinder No. 5	90
Piston cooling water, cylinder No. 6	99
Jacket cooling water, cylinder No. 1	75
Jacket cooling water, cylinder No. 2	72
Jacket cooling water, cylinder No. 3	69
Jacket cooling water, cylinder No. 4	73
Jacket cooling water, cylinder No. 5	75
Jacket cooling water, cylinder No. 6	74
Exhaust gases, cylinder No. 1	670
Exhaust gases, cylinder No. 2	739
Exhaust gases, cylinder No. 3	679
Exhaust gases, cylinder No. 4	758
Exhaust gases, cylinder No. 5	752
Exhaust gases, cylinder No. 6	680
Air compressor, cooling water	70
Air compressor, l.p. discharge	272
Air compressor, i.p. inlet	62
Air compressor, i.p. discharge	254
Air compressor, h.p. inlet	84
Air compressor, h.p. discharge	341
Engine room	64
Deck	60
Sea	46
Fuel oil tanks (daily supply)	55
Lubricating oil	97

Fuel consumption average per i.hp., including one 40-kw. auxiliary generating set .... 0.319 lb. per hr.

Following auxiliaries were in operation during trial:

1—Auxiliary generating set (voltage 221-amps. 111).
1—Cooling water circulating pump.
1—Lubricating oil circulating pump.
1—Sanitary pump.
1—Bilge pump (intermittent).
1—Donkey boiler (kept up to pressure during trial, but did not furnish steam to heating and deck lines while the exhaust gas generator or boiler was in operation).
1—Donkey boiler feed pump.
1—Donkey boiler fuel oil service pump.
1—Auxiliary condenser.
1—Auxiliary condenser circulating pump.
1—R. & D. exhaust gas generator.
1—Auxiliary condenser air pump.

Mean speed on several runs .. 10.893 knots at a mean r.p.m. of 107.5

Civil Service Examinations

An examination is to be held for junior engineers qualified in naval architecture and marine engineering to fill vacancies in various branches of the government service throughout the United States. Applications must be made to the Civil Service Commission before August 8th. The entrance salary in the District of Columbia is $1,860 a year and advancement in pay may be made without change in assignment up to $2,400 a year. The rate will be approximately the same for appointments outside Washington, D. C.

An examination will be held for positions of nautical assistants in the hydrographic office of the Navy Department and applications must be made to the Civil Service Commission before August 29th. The entrance salary will be $1,680 a year, with advancement in pay without change in assignment up to $2,040 a year.

Notice has also been issued that positions of local and assistant inspector of hulls and of local and assistant inspector of boilers are vacant in the Steamboat Inspection Service. Applications will be received up to August 29th, inclusive. The entrance salaries are from $2,700 to $3,600 a year, depending upon the qualifications of the appointee as shown in the examination and the duty to which assigned.

Standard Engine Bidding Specifications

Many Diesel Engine Builders Accepted the Standard Form Recently Issued by the New York Central R. R.

A TEST of the utility of the plan outlined in our June issue to end the confusion of varied bidding forms used by Diesel engine manufacturers has been made by the Marine Department of the New York Central R. R.

Invitations were issued for bids on two engines required, and bidders were asked to use the specification reprinted here in full. About 15 Diesel engine builders responded. After the bids had been received they were examined and compared in a fraction of the time that would have been necessary had each manufacturer used his own form.

Only two or three engine builders took exception to any part of the specification, one for instance, on the item of fuel pumps, another on crankcase compression.

A demonstration has thus been given that the interests of buyers and engine builders do not conflict in this effort towards simplification of business. The way is open for progress towards a uniform series of specifications to cover all sizes of engines and all types of propulsion.

In the particular case in which these bidding specifications were used by the New York Central R. R. the engines were to be of 250s.hp.-300s.hp. for a gear drive and non-reversing. Very few changes would have to be made to alter the specifications for trunk piston engines with electric drive, and the additions required to fit the specifications to reversing engines would not be numerous.

Standard Engine Bidding Specifications Used by New York Central

GENERAL

1. Engines to be oil burning internal combustion engines of vertical type, between ... and ... s.hp. They shall be suitable for ...., 4 or 6 cylinders, ... to ... r.p.m., ..., 2-cycle or 4-cycle, air or airless injection and thoroughly accessible when installed. The 2-cycle engines must have other than crankcase compression in order to receive efficient scavenging. They shall be of fully enclosed type, fitted with forced feed lubrication. They shall conform to the latest requirements of the American Bureau of Shipping. All parts shall be clearly marked for reassembling, and parts must be interchangeable where practical and as may be desired, as between the same type of engines of the same builder.

BASE

2. Bottom to slope to drain all lubricating oil to common pump suction. Flanged base to give ample bearing surface. Proper extension of base to be made in case of air injection to carry compressor and scavenging pump. Base to have bolt holes, as approved, for fixing to foundation. Means shall be provided for showing oil level in the base.

CRANKCASE AND CRANKSHAFT

3. Crankcase shall be of rigid construction, of approved design, so arranged as to safely take all stresses to which it is subjected. Crankcase to be firmly bolted to the base. Engines to be wholly enclosed by oiltight doors arranged to examine all covered parts.

Crankshaft shall be of the solid rigid steel type, carefully turned and polished at all bearing surfaces. It shall be interchangeable with that of any other unit of this size, built by the same manufacturer, made of high grade open hearth, forged steel. A suitable coupling or flywheel hub shall be provided for connecting to generator, gear or propeller shaft. The manufacturer shall investigate the question of critical speeds and torsional vibrations so that a critical speed of the first period shall not exist within 10 per cent of the speeds at which the engine is likely to operate in service.

PISTONS

4. Pistons shall be cast iron, air or oil cooled, of uniform structure and of the best heat resisting quality. They shall be accurately machined with side clearance as approved, grooved for suitable number of rings. Location, design, material and number of piston rings to be approved by owner. Pistons must be sufficiently heat treated to prevent warping. When pistons are air or water cooled the manufacturer shall supply coolers, pumps, piping and all necessary equipment for efficiently performing this cooling. Pistons shall have sufficient skirt to transfer heat to jacket.

CONNECTING RODS

5. Connecting rods to be of open hearth forged steel, having cast steel piston pin or crosshead and crankpin boxes. The crankpin boxes may be of the so-called strap construction. To be lined with best grade babbitt. Piston pin and rod may have forged eye and fitted with bronze sleeves, which shall be provided with suitable means to keep sleeve central and for taking up wear. The boxes shall be secured to the connecting rods by fitted bolts. These bolts shall be made of a high grade material best adapted for resisting fatigue. Boxes shall be provided with laminated or multiple shims, properly numbered for location, where the two halves join at center-line of pins, and between connecting rods and crankpin boxes. Connecting rods for injection air compressors and scavenging pumps shall be constructed in the same manner as above.

WATER JACKETS

6. When cylinder liners are used and where heads are required together with water jackets, they shall be separate castings so designed to permit free expansion, independent of each other. The water jackets shall be accurately bored to size and faced to set square on the cylinder supports, columns or crankcase, and shall line up accurately with the center line of the engine. Large removable covers are to be provided for cleaning the jacket spaces.

CYLINDER HEADS

7. Cylinder heads shall be of uniform structure cast iron. Necessary openings for valves shall be provided, so arranged to permit free circulation of water around them. Removable covers shall be provided for cleaning valves, etc. Cooling water must be taken from cylinder jacket to cylinder heads through outside connection to prevent leakage of water into cylinders. There shall be no oil leakage from valve, etc. Ground metal to metal joints are required and no gaskets will be allowed, except in the water joints.

CYLINDER LINERS

8. If cylinder liners are used they shall be made of a uniform and very hard cast iron, capable of resisting combined heat and pressure stresses and wear. They shall be accurately bored and fit well into water jackets. They shall be aged before final finishing.

Question—What is average time to remove and replace cylinder liner, taking engine from working condition and replacing to working condition?

Answer— ....

....

Question—If no cylinder liner is used what is average time necessary to dismantle engine from working condition, replace cylinder so engine is ready to operate?

Answer— ....

....

Note: The above two questions must be answered by results of an actual test made by two men with no outside assistance, the men working no faster than the average mechanic. Before purchase this company will ask to have the test repeated.

SIDE SHAFT

9. Side shaft where used to be geared to crankshaft, to have a suitable arrangement for operating valve eccentrics, etc., to be approved by representative of this Company.

CAMSHAFTS AND CAMS

10. The camshafts for fuel injection, air and exhaust valves and starting shall be open hearth forged steel, accurately ground to size and driven from main crankshaft through suitable machine cut spur, bevel, herring-bone or helical gears. Where bevel or helical gears are used, suitable adjustable thrust collar shall be provided. These gears shall be lubricated from the forced feed system and shall be enclosed in oiltight cast iron cases. All gears shall have hunting teeth, where speed ratio allows, and be clearly marked for reassembling. Cams shall have ample width, accurately bored, keyed to shaft and shall be ground from master cams. The fuel valve cams shall be adjustable. Cams and rollers to be open-hearth forged steel and hardened, or cast iron with face greatly hardened. Gears and cams shall be noiseless.

BEARING METAL

11. All babbitt to be tin base to meet Navy Specifications or equal. It shall be installed as explained later on in this specification.

MAIN BEARINGS

12. The main bearings shall be of heavy construction and furnish ample bearing surface to receive the pressures to which they are subjected. They shall be so designed that the lower half of the bearing can be removed for re-babbitting or replacement without disturbing the crank shaft.

Main bearing shells, when used, shall be heavy to prevent distortion. They shall be scraped into the seatings in the base and lined with babbitt metal as specified. The bearings shall be arranged so that they may be removed quickly, but means must be provided so that there is no end movement. The babbitt shall be anchored in dovetail grooves, if steel shells are used.

Laminated or multiple shims properly marked for location shall be provided at the center line of all main bearings. The main bearing caps shall be held in place by bolts, pocketed into the engine base or by suitable studs. Where bolts are used, permanent provisions shall be made against lubricating oil leakage along bolts to tank top.

The manufacturer is to supply this company with bridge gauge on which is stamped original measurement of each finished main bearing. These measurements shall also be stamped in an approved place on the engine.

Babbitt shall be of uniform thickness and be tight in shells without peening.

Manufacturers must finish alignment of bearings and shaft so that wear on bearings shall be uniform, and must guarantee to replace all crankshaft breakage due to uneven wear of bearings.

WRIST PINS

13. Pins to be of high grade open hearth forged steel, properly heat treated and accurately ground to size. Pins shall be rigidly secured against turning in the piston bosses and also against any axial movement which might result in cylinder scoring.

VALVES

14. In four-cycle engines exhaust and inlet valves shall be interchangeable. They shall be arranged in removable cast iron cages seated in the head, where size of cylinder will permit, at the same time allowing sufficient water circulation for cooling. Cages shall be interchangeable. The exhaust cages only to be water cooled. Fuel valves to be approved by this Company. Two-cycle engines may be of the port or poppet valve scavenging type having valve in the head.

GOVERNORS

15. To be of approved design, powerful and sensitive, to effectually vary the stroke or operate the suction or bypass valves of the fuel pumps, so as to properly control the speed of the engine under all load conditions. Engine to be guaranteed that variation from rated full load speed will not exceed 2 per cent either way under gradual change from one-fourth to full load and 3 per cent from no load to full load and vice versa. The variation of the ratio full load speed shall not vary more than 5 per cent with an instantaneous decrease from full load to one-fourth load or 7 per cent with instantaneous change from full load to no load or vice versa. There shall be an emergency cut off to take care of governor failure.

LUBRICATION

16. All working and moving parts shall be efficiently lubricated. All engines, except those without crosshead, shall use a full forced feed pressure system. Oil cups to be provided where hand lubrication is necessary. The working cylinder, compressor cylinders, etc., to have approved force feed lubrication with needle feed for compressor.

SCAVENGING PUMPS

17. In case of 2-cycle engines, the scavenging pumps shall be suitably direct driven from the engine and shall be of ample capacity to properly scavenge working cylinders, and this capacity must be at least one and one-half times the cylinder displacement. Valves to be accessible and readily removed and may be automatic or mechanical.

FUEL PUMP

18. For air injection engines, fuel pump to be of multiple plunger type with one plunger for each fuel valve. For airless injection, fuel pump to be single plunger type with distributor which permits of the load being divided with great exactness between the various cylinders. Plungers shall be of high grade steel, tempered and ground to size and shall line up accurately with pump body.

The action of pumps to be approved by this Company.

Each plunger where multiple to have suitable primer. Oil leakage to be caught and piped to sump tank. Each cylinder to have test cock.

AIR INJECTION COMPRESSORS

19. Injection air compressor to be driven direct from the engine, to be 3-stage and of ample capacity. Valves to have ample areas and be in removable cages and to be removed without breaking pipe connections. Compressor delivery to be controlled other than by throttling the intake. Compressor intake manifold to be arranged to take low pressure suction from outside the engine room. If compressor is too small for three stages, two stage will be allowed. State which is being used when making bids.

OVER SIZE INJECTION AIR COMPRESSOR

20. If oversize injection air compressor is included in proposal, what actual excess air capacity will it have?

Answer ....

Suitable approved means to be arranged to vary capacity of compressor.

FLYWHEEL

21. Flywheel to give smooth running. To be carefully turned and accurately bored and statically balanced and have a running balance. All points for the cycle of operation for all cylinders to be stamped on rim of flywheel with pointer on engine base to accurately set these points. Flywheel to be designed to have engine as level as possible when seated in boat. Some efficient means shall be provided for turning engine by power, such as turning or airjack.

OUTBOARD BEARINGS

22. Outboard bearings to be approved by this Company. To be of the self aligning, adjustable type. Bottom half to be supported on spherical socket, adjustable in a vertical plane. Ample provision to be made to prevent leakage of lubricating oil.

SPARES

23. The manufacturer shall supply with each engine a complete set of spares as required by the American Bureau of Shipping.

TESTS

24. The engines shall be given a four day non-stop run at rated power and r.p.m. at Engine Works. Of this run, 24 hours shall be at 10 per cent overload, ½ hour at 25 per cent overload, 2 hours at 10 per cent higher r.p.m. than normal. There shall be a test to determine governor action. All data obtained during above trial to be furnished the owner, and test to be under his control. If this Company decides to eliminate any part of these tests, allowance shall be made of the actual cost or part thereof and this Company reimbursed accordingly. Engine to be dismantled at end of test for this Company's inspection.

PAINTING

25. Engines shall be given two coats of approved paint before leaving shop.

HORSE POWER

26. The rated b.hp. is .... and the m.e.p. upon which computed is .... The maximum b.hp. for this engine is........ .... The b.hp. to be obtained with actual test by use of waterbrake on the engine of this type and class.

PRICE—BID ON ABOVE ENGINE

27.

No.	Item	Amount
......	Engines, including silencers, flywheel, flywheel barring gear, compressor for injection air, (if air injection), outboard bearing, compressor air intercooler and aftercooler, lubricating system, wrenches and tools, spare parts, fuel oil pump.	......
......	Injection air receiver	......
......	Injection air bottles	......
......	Starting air receiver	......
......	Starting air bottles	......
......	Generator shaft (if used)	......
......	Fuel oil heater	......
......	Fuel oil strainer	......
......	Fuel oil separator	......
......	Thrust bearing	......
......	Platform and ladders	......
......	Built in circulating water pump	......
......	Lubricating oil cooler	......
......	Miscellaneous itemized	......
	Total	......

GENERAL DATA

28.

B.hp. (Rated) ....

B.hp. (Maximum) ....

M.e.p. (Rated) ....

R.p.m. ....

Fuel guarantee in lb. based on 18,500 B.t.u. per lb. at sea level.

(1) B.hp. hour at rated load ....

(2) B.hp. hour at ¾ load ....

(3) B.hp. hour at ½ load ....

(4) B.hp. hour at ¼ load ....

What is your lubricating oil guarantee, with quality of oil specified? Answer............

....

....

....

....

Limiting grades of fuel oil?...............

Bore? ....

Stroke? ....

Net Weight ....

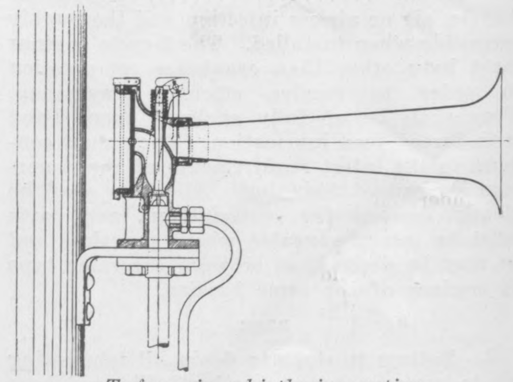
DELIVERY

29. Delivery will be made to cars at plant in .... days from date of receiving order.

Whistle Air Economy

All the earlier motorships were equipped with whistles of the pattern that has been used for years on steamers. These were not very economical in their use of steam, but nobody ever counted the cost of the steam.

With the same type of whistle on motorships the engineers soon noticed that the amount of air used was insignificant at sea, but inconveniently large during foggy weather



Tyfon air whistle in section

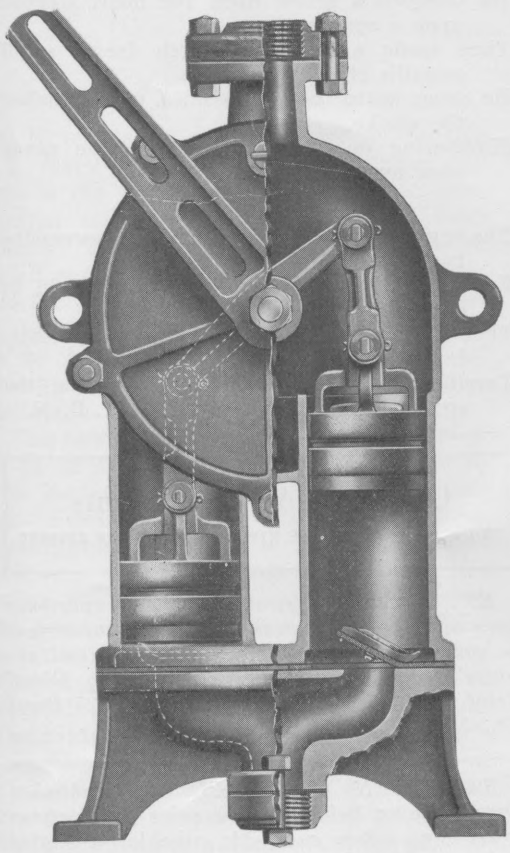
or in crowded waters, precisely when the air supply was most needed for maneuvering. Nobody took any notice of their complaints for a number of years, but they finally found a friend in a Swedish engineer, H. Rydberg, who invented an air whistle consuming only one-fifth of the quantity of air required by the old type whistle. His invention was taken up by the Kockums Mekaniska Verstad A/B of Malmö, Sweden.

The apparatus has been adopted gradually on Scandinavian vessels during the last five years and has now attained quite a vogue.

Rydberg's whistle is marketed under the name of the Tyfon, and is made in different types and sizes for different classes of vessels. The horn is made of copper, the cast parts are of brass and the diaphragm is of phosphor bronze, so that it is entirely suited for continued operation in salt air.

Serviceable Hand Pump

On the tug HUGH O'DONNELL, recently converted from steam to Diesel power for the O'Donnell Transportation Co. of New York City, the fuel transfer pump is of the hand type and the engineers are quite proud of the speed at which they can fill the day tanks with it. For its purpose it is exceedingly handy and convenient. It occupies little space, is operated by a swinging handle and seems to demand relatively little energy for pumping. The construction of the pump is shown in the accompanying illustration. There are two cylinders in which the plungers operate alternately, producing the same effect as in a double acting pump. The plungers are leather packed, with brass poppet valves, and the suction valves are of leather. The manner in



Double cylinder hand pump

which the lever is connected to the plunger is clearly shown, and the operation will readily be understood.

On the HUGH O'DONNELL with a suction and discharge of 1¼-in. diameter, the pump can lift 7.6 gallons per minute at 45 strokes per minute. The pump is made by the Goulds Manufacturing Co. of Seneca Falls, N. Y., in several different sizes, either with a base for fastening to the floor or with lugs for securing to a side frame or bulkhead.

Catalogs

Electric Heat. A 16-page booklet about industrial heating. Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.

Federal Sirens. An 8-page booklet dealing with the electric sirens made by the Federal Electric Co., 8700 South State Street, Chicago.

Modern Methods in Engine Building. Bulletin 1040, a 32-page illustrated description with color plates of the production of Diesel engines, by Fairbanks, Morse & Co., of Chicago.

Sperry High Intensity Searchlight. Publication No. 20-1615. A 20-page illustrated description of the features which have increased the efficiency of the modern projector. The Sperry Gyroscope Co., Manhattan Bridge Plaza, Brooklyn, N. Y.

Review of Recent Publications

The Ports of Gulfport and Pascagoula, Miss.

Port series No. 19. Prepared by the Board of Engineers for Rivers & Harbors, War Department, in cooperation with the Bureau of Research, United States Shipping Board. 9 in. x 5¾ in. 106 pp. 30 cents. Sold by the Superintendent of Documents, Government Printing Office, Washington, D. C.

With the issue of this report there are now 11 books available in this series. The volumes numbered 8 to 10, number 12 and numbers 15 to 18 inclusive, have not yet been completed. This report contains information similar to that already noticed in the reviews of the earlier books of the series, and in addition thereto the railroad rate situation as affecting competition among the several Gulf Ports and the competition between the Gulf Ports and the Atlantic Ports is made clear by tables showing the existing rates.

The ports of Gulfport and Pascagoula are among the smaller ports of the Gulf coast, but the former particularly has an important commerce and serves as a gateway not only for a large amount of traffic originating in the State of Mississippi, but also that to and from more remote points of the interior. It is the port through which one of the principal asphalt companies imports Trinidad asphalt for distribution throughout the entire Central West. Gulfport enjoys a substantial general import and export trade in competition with Mobile and New Orleans, particularly by reason of the low terminal charges. It is in all respects a railroad port, the terminal facilities having been established by the Gulf and Ship Island Railroad and the business developed through the enterprise of this company. Imports through Gulfport during 1921 were forwarded to 27 States. Bananas went to 25 States and to the Province of Quebec. This port is also conspicuous for imports of molasses and creosote and for exports of lumber products. The report shows that the trade of the port of Pascagoula consists mainly of lumber, fish and supplies for local consumption.

Questions and Answers Relating to Diesel, Semi-Diesel and Other Internal Combustion Engines

By John Lamb, M. I. Mar. E. 5¼ in. x 4 in. 280 pp. Published by Charles Griffin & Co., Ltd., London. Obtainable from Technical Book Dept., MOTORSHIP, *27 Pearl St., New York. Price $2.50; mailing extra.*

One of the most popular books among steam engineers who are educating themselves on Diesel engines has long been John Lamb's "Questions & Answers." A second edition has just been brought out, containing 70 pages more than the first edition. Lamb states in his preface that he has incorporated in the new edition those points of difficulty which have been submitted to him by correspondents from all parts of the world who have not found the problems dealt with in the first book. The author has given the solution to these additional points in the form of a supplement added to his original book. The second edition thus becomes as valuable to the readers of the first edition as it is to entirely new readers. The author chose to adopt this method of enlarging the book partly in order to keep down the price and partly in order to retain the original style of headings. In the new edition an index has been included, which helps the reader as a cross reference between the old book and the new supplement. The additional questions and answers include even such problems as torsional vibrations and critical speeds. The fundamental simplicity of the author's style has been retained.

For the service of readers of this magazine, the MOTORSHIP *maintains a Technical Book Department at 27 Pearl St., New York, through which copies of books can be obtained. The principal books on oil engines and motorships are carried in stock.*

Personal Notes

G. S. Clark, author of the Standard Engine Bidding Specifications used by the New York Central R. R., has been appointed Assistant to the Manager, Marine Dept., N. Y. C. R. R.

Captain R. D. Gatewood has been appointed District Director of the U. S. S. B. Emergency Fleet Corporation for the New York district, with headquarters in New York City. He will assume his new duties on August 1st, and in addition to serving as the District Director for New York, will continue as the head of the Maintenance and Repair Division of the corporation. His management of the conversion of the 14 Shipping Board vessels from steam to Diesel power will therefore not be interrupted.

Julius Kuttner, whose series of articles on "Sketching & Working of Oil Engines" forms one of the most instructive expositions of the oil engine that has ever been published, has been appointed Editor of OIL ENGINE POWER. Last winter he gave a course of lectures on Diesel and Oil Engines at the Polytechnic Institute, Brooklyn, attended by 150 marine engineers and superintendents, oil engine salesmen and others connected with the oil engine business. Due to the success of that course the Brooklyn Polytechnic Institute has arranged for him to give another series of 20 lectures beginning October 3rd and continuing through the winter. Mr. Kuttner is a graduate of the Mass. Institute of Technology. After receiving his degree in 1915, he obtained a position on the erecting floor of the Busch-Sulzer Bros. Diesel Engine Company. From there he went to join the late Mr. Setz as special assistant in the Diesel Engine Department of the Manitowoc Shipbuilding Company. In order to obtain practical operating experience under service conditions he later went to sea on several motorships. In 1921 he went to Germany and spent two years there as test engineer and designer in several of the big oil engine factories. Upon returning to the United States he joined the New York Shipbuilding Corp. as First Assistant on the m.s. ASHBEE. Since the beginning of 1924 Mr. Kuttner has been connected with the Freeman-Palmer publications as Assistant Editor of MOTORSHIP and of OIL ENGINE POWER.

George Weiss, who for the past seven years has been Editor of the *Marine News* has resigned in order to accept appointment as General Manager of Sales of the Ajax Rope Company of New York. Mr. Weiss has for many years been recognized as a keen analyst of world shipping affairs. R. S. O. Lawson, president of the Ajax Rope Company, in announcing the appointment of Mr. Weiss said, "I am very pleased to be able to announce that George Weiss, Editor of the *Marine News* will assume the post of General Manager of Sales of this company. He enjoys both a broad knowledge of shipping affairs and a wide circle of friends throughout the shipping industry."

Messroom Maxims and Fables

FUEL, air, water and oil are the elements which make the motor go—the rest is up to you.

A good habit is to be in the engine room when "turn to" strikes.

How many really appreciate the meaning of the little red notice SAFETY FIRST?

No use to think the fuel pumps will run forever without having the valves ground from time to time.

Which reminds us that a leaking valve can be compensated for by readjustments from time to time, but in time the limit of fuel pump adjustment will be reached.

It is going to be up to the engineers to take care of broken up deck machinery. A little spunk and an argument with the deck force is therefore sometimes justified.

Time we got in the habit of using air tools. They are going to be as indispensable on a motorship as hacksaws, hammers and wrenches some of these times.

Men from repair yards may be honest enough, but they are most awful careless about returning tools they borrow.

And that reminds us that both sides always claim they have lost some tools.

When the sanitary system does not work, you may get sick as well as the men.

It is better to do one good job than a multitude of poor ones.

When the store room is left unlocked the stores seem to take legs and walk.

Now let's not throw a bucket of water on any more electric fires. It is a bad practice to get too many things started at the same time.

Some purchasing agents do not seem to know that if men are going to steal the paint to take home they will steal it whether there is one gallon or fifty in the stores.

We are agreed that to wash the paint always makes the engine room cleaner.

A set of leads indicates the bearing clearance, and as yet we have not found anyone who can guess it nearly so accurately.

You can quit if you do not want to do what the port engineer asks. He has the upper hand, and since the big boss seems to know who he wants for the job it would appear that he is going to keep it.

Don't forget to enter fire and boat drill in the log.

A sounding tells how much is in a tank.

This is a good one: 86,000 drops, more or less make a gallon; if each piston rod on a six-cylinder engine leaks one drop of oil every up-stroke, how much oil will be lost? 39,600 up-strokes are made per hour if the engine turns 110 r.p.m.

The Tinkering Engineer

Tinkering and playing and monkeying with the job,
He never could be happy with the smooth rhythmic throb
Of an engine working with a constant power flow
And he had to tamper with the parts that made it go.

He tinkered with the fuel pumps and with injection air,
While imaginary crank-box thumps resounded everywhere.
Thought he heard combustion-knocks, sniffed the air for smoke
And set up on the thrust blocks—uncertain of his stroke.

But the job kept on running in a satisfactory way
Despite the crazy antics he performed throughout the day.
For some engines are built on an almost fool-proof plan
Preventing many troubles brought about by such a man.

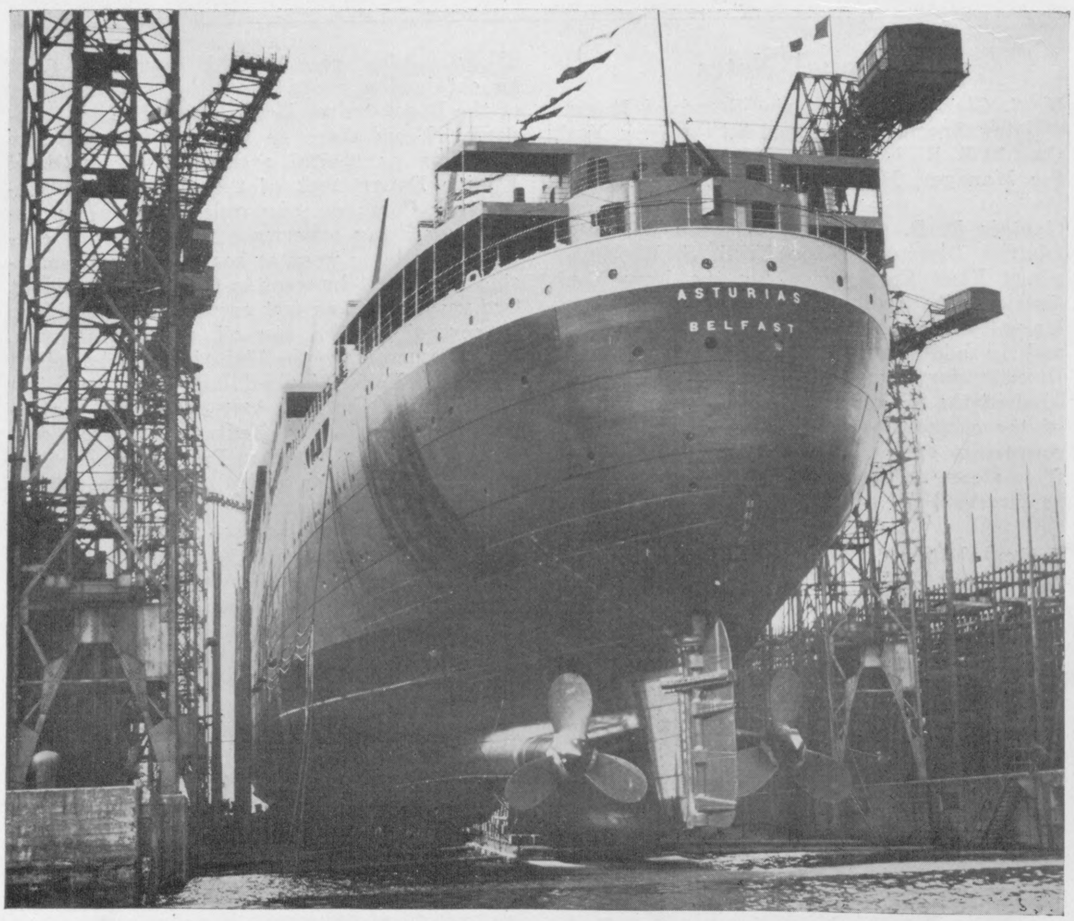
He read the pressure gauges and thermometers as well.
He said, "I'll bet my wages they was only made to sell.
They serve no useful purpose. Their construction isn't sound.
You'd think it was a circus since spangles so abound."

He took them from their places—the engine ran along,
Examined their condition, not suspecting what was wrong.
Just as busy as a boy with a battered broken clock,
He never heard that engine—it started in to knock.

He dropped a screw upon the floor, stepped upon a spring,
Then made a fruitless search for a small metallic ring.
He never heard the engine miss, never smelled the smoke,
Slumbering on thru tinker's bliss he never once awoke.

The engine labored harder with each successive turn;
For want of cooling water it started in to burn.
Then the tinkerer awoke, for the compressor, far too hot,
Terrifically exploded and killed him on the spot.

A. B. N.



Stern view of 22,000 ton motorliner Asturias launched last month at Belfast